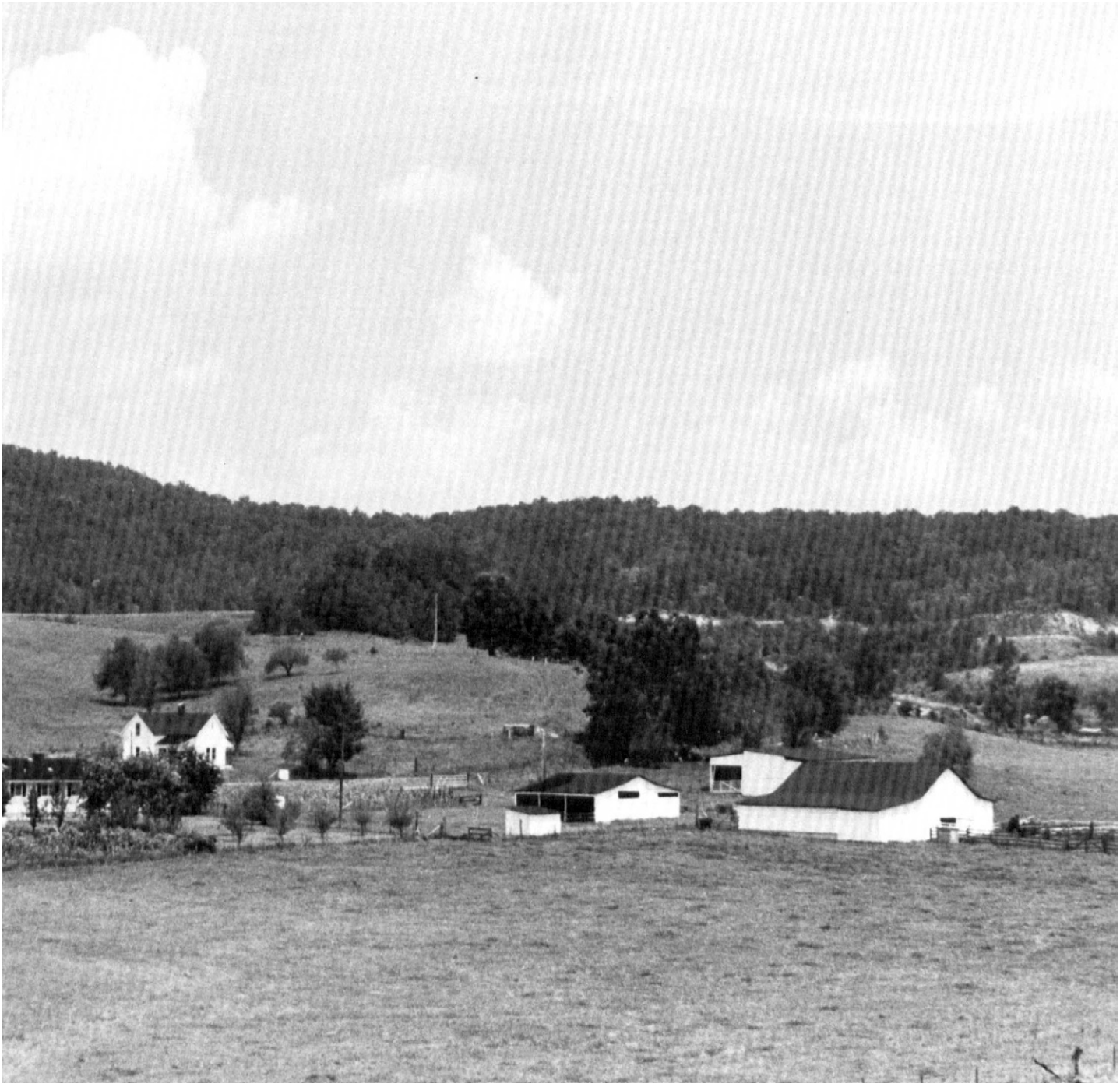
United States Department of Agriculture

Soil Conservation Service

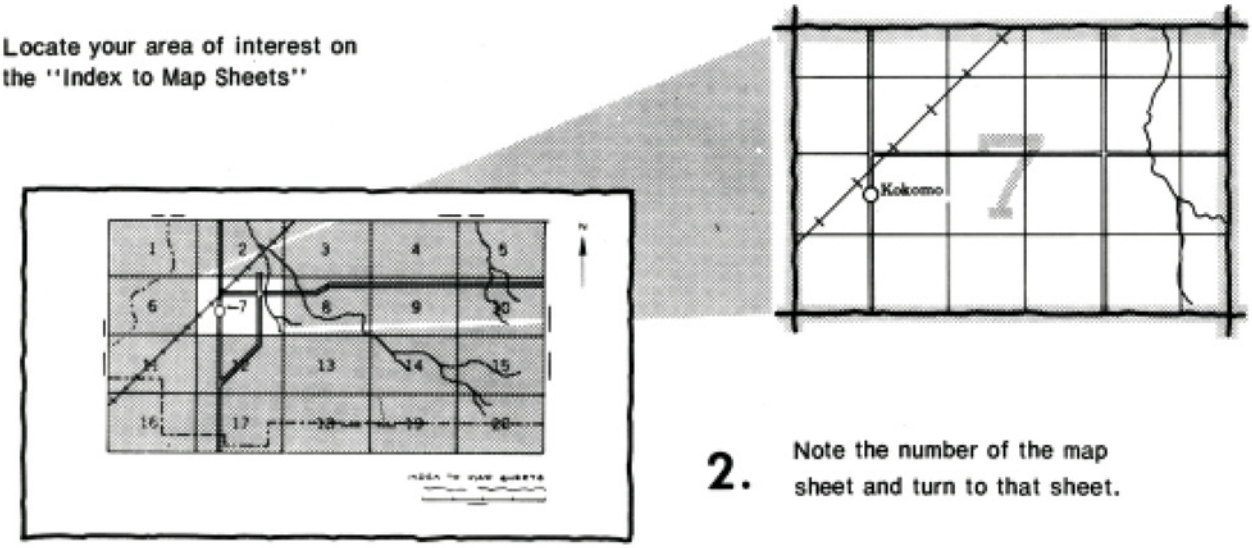
In cooperation with Kentucky Natural Resources and Environmental Protection Cabinet and Kentucky Agricultural Experiment Station

Soil Survey of Knox County and Eastern Part of Whitley County, Kentucky



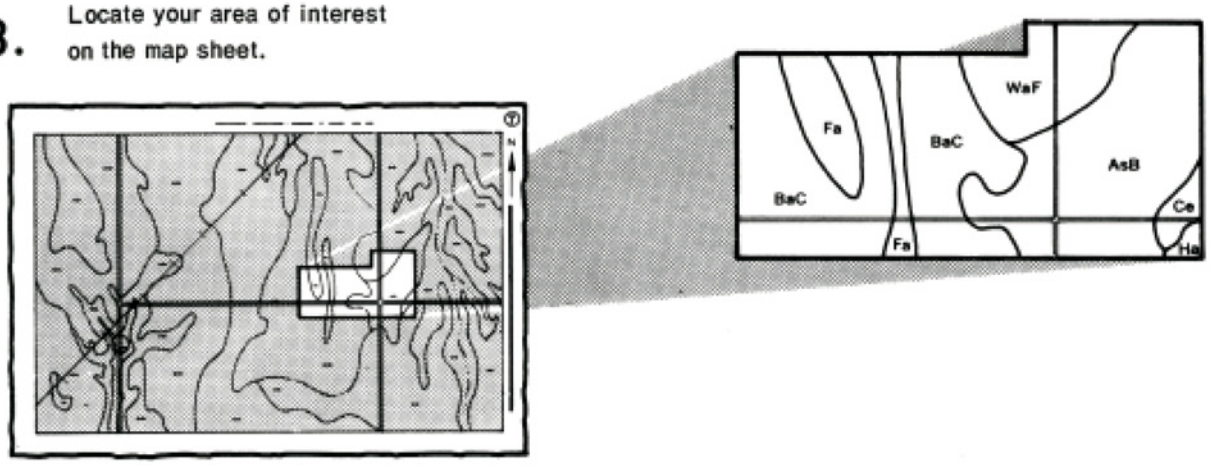
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

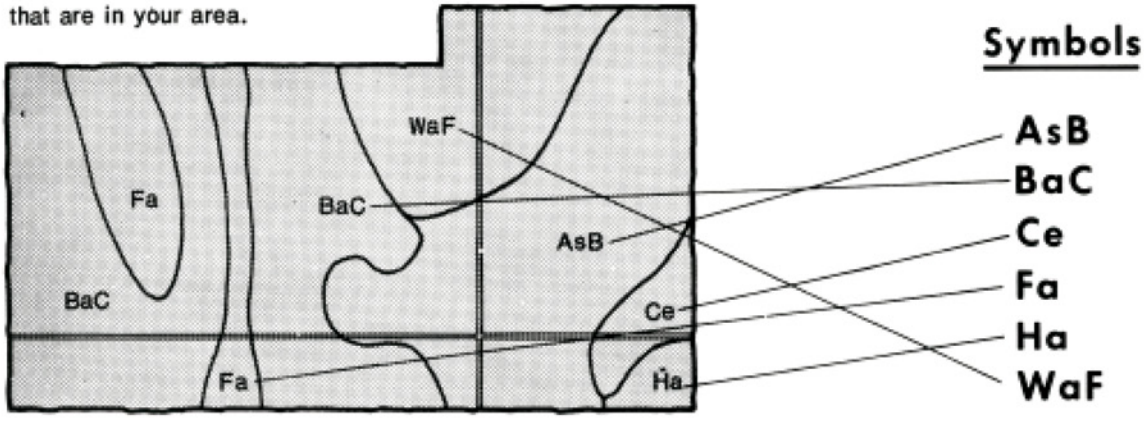


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

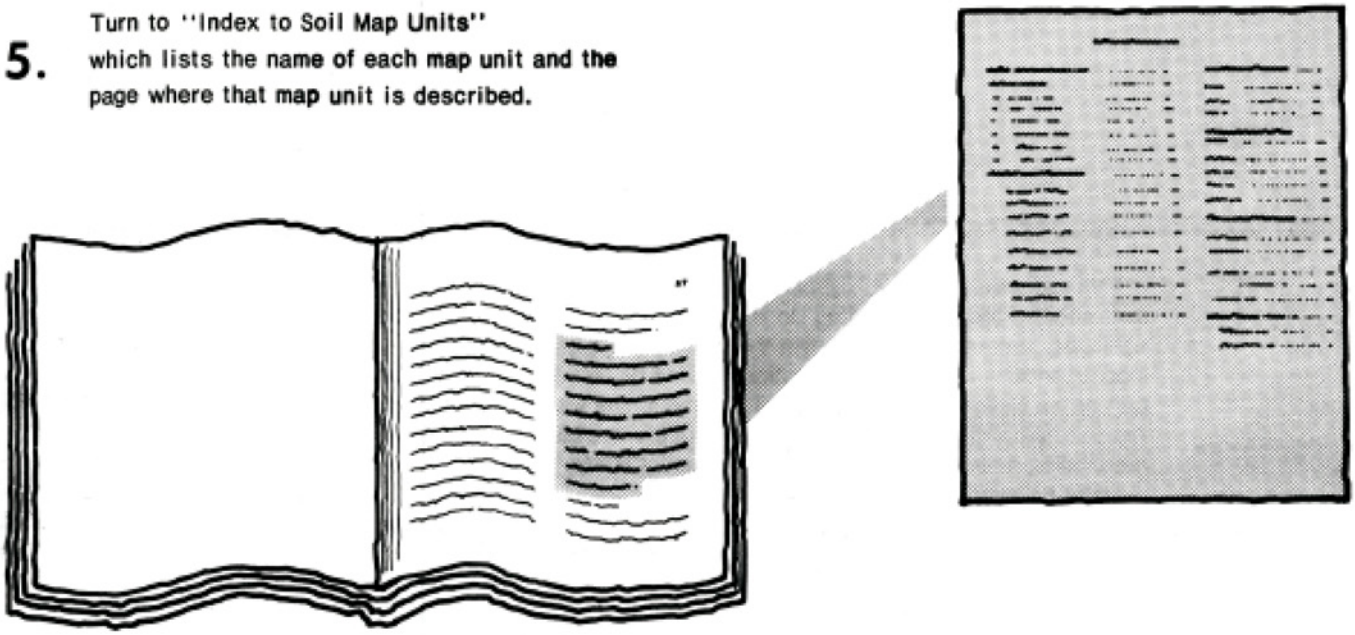


4. List the map unit symbols that are in your area.

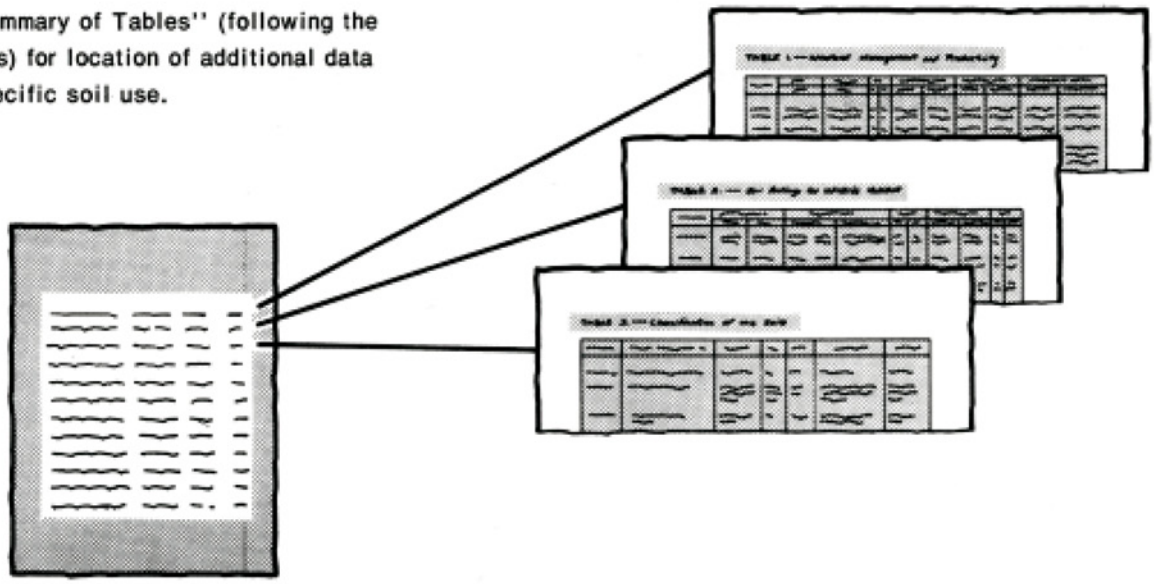


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This soil survey was made cooperatively by the Soil Conservation Service, the Kentucky Natural Resources and Enivronmental Protection Cabinet, and the Kentucky Agricultural Experiment Station. It is part of the technical assistance furnished to the Knox County Conservation District and the Whitley County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Stendal silt loam, frequently flooded, (in the foreground) is used mainly as pasture and for hay. Flooding generally does not occur in the growing season. The soils in pasture in the background are in the Shelocta and Wernock series. The woodland is on Shelocta-Latham silt loams, 30 to 60 percent slopes.

Contents

Index to map units iv
Summary of tables v
Foreword vii
General nature of the survey area 2
How this survey was made 4
Map unit composition 5
General soil map units 7
Detailed soil map units 19
Prime farmland 51
Use and management of the soils 53
Crops and pasture 53
Woodland management and productivity 59
Recreation 62
Wildlife habitat 63
Engineering 65
Soil properties 69
Engineering index properties 69
Physical and chemical properties 70
Soil and water features 71
Physical and chemical analyses of selected soils 72
Engineering index test data 72
Classification of the soils 73
Soil series and their morphology 73
Formation of the soils 87
Factors of soil formation 87
References 91
Glossary 93
Tables 99

Soil Series

Allegheny series 73
Bethesda series 74
Bledsoe series 75
Bonnie series 75
Clarkrange series 76
Cotaco series 77
Cuba series 77
DeKalb series 78
Fairpoint series 78
Huntington series 79
Latham series 79
Lily series 80
Morehead series 80
Newark series 81
Pope series 81
Rigley series 82
Shelocta series 82
Steinsburg series 83
Stendal series 84
Stokly series 84
Wernock series 85
Whitley series 85

Issued May 1988

Index to Map Units

AlB—Allegheny loam, 2 to 6 percent slopes 19
AlC—Allegheny loam, 6 to 12 percent slopes 20
AlD—Allegheny loam, 12 to 20 percent slopes 20
AnB—Allegheny loam, 2 to 6 percent slopes, rarely flooded 21
AnC—Allegheny loam, 6 to 12 percent slopes, rarely flooded 21
AnD—Allegheny loam, 12 to 20 percent slopes, rarely flooded 23
BEF—Bledsoe-Shelocta-Rock outcrop complex, 15 to 90 percent slopes 23
Bo—Bonnie silt loam, frequently flooded 24
ClB—Clarkrange silt loam, 2 to 6 percent slopes 24
Co—Cotaco loam, rarely flooded 25
Cu—Cuba silt loam, frequently flooded 25
FBC—Fairpoint and Bethesda soils, 0 to 20 percent slopes 26
FBF—Fairpoint and Bethesda soils, 20 to 70 percent slopes 28
Hu—Huntington silt loam, occasionally flooded 29
LaC—Latham silt loam, 6 to 12 percent slopes 29
LaD—Latham silt loam, 12 to 20 percent slopes 31
LDF—Latham-DeKalb complex, 30 to 60 percent slopes 31
LlC—Lily loam, 6 to 12 percent slopes 32
LSD—Lily-Steinsburg fine sandy loams, 12 to 30 percent slopes 33
Mo—Morehead silt loam, rarely flooded 33
Ne—Newark silt loam, occasionally flooded 35
Pd—Pits-Dumps complex 35
Pg—Pope gravelly fine sandy loam, frequently flooded 35
RSF—Rigley-Shelocta-Rock outcrop complex, 30 to 60 percent slopes 37
ShB—Shelocta gravelly silt loam, 2 to 6 percent slopes 37
ShC—Shelocta garvelly silt loam, 6 to 12 percent slopes 39
ShD—Shelocta gravelly silt loam, 12 to 20 percent slopes 39
SLE—Shelocta-Latham silt loams, 20 to 30 percent slopes 40
SLF—Shelocta-Latham silt loams, 30 to 60 percent slopes 41
SSF—Steinsburg-Shelocta-Rock outcrop complex, 35 to 80 percent slopes 42
St—Stendal silt loam, frequently flooded 43
Sv—Stokly fine sandy loam, frequently flooded 43
WnB—Wernock silt loam, 2 to 6 percent slopes 44
WnC—Wernock silt loam, 6 to 12 percent slopes 45
WnD—Wernock silt loam, 12 to 20 percent slopes 46
WtA—Whitley silt loam, 0 to 2 percent slopes, rarely flooded 46
WtB—Whitley silt loam, 2 to 6 percent slopes, rarely flooded 47
WtC—Whitley silt loam, 6 to 12 percent slopes, rarely flooded 47

Summary of Tables

Temperature and precipitation (table 1) 100

Freeze dates in spring and fall (table 2) 101
Probability. Temperature.

Growing season (table 3) 101

Acreage and proportionate extent of the soils (table 4) 102
Knox County. Whitley County. Total—Area, Extent.

Land capability classes and yields per acre of crops and pasture (table 5) 103
Corn. Wheat. Tobacco. Soybeans. Alfalfa-hay. Grass-legume hay. Pasture.

Capability classes and subclasses (table 6) 106
Total acreage. Major management concerns.

Woodland management and productivity (table 7) 107
Management concerns. Potential productivity. Trees to plant.

Recreational development (table 8) 115
Camp areas. Picnic areas. Playgrounds. Paths and trails. Golf fairways.

Wildlife habitat (table 9) 119
Potential for habitat elements. Potential as habitat for—Openland wildlife, Woodland wildlife, Wetland wildlife.

Building site development (table 10) 122
Shallow excavations. Dwellings without basements. Dwellings with basements. Small commercial buildings. Local roads and streets. Lawns and landscaping.

Sanitary facilities (table 11) 126
Septic tank absorption fields. Sewage lagoon areas. Trench sanitary landfill. Area sanitary landfill. Daily cover for landfill.

Construction materials (table 12) 130
Roadfill. Sand. Gravel. Topsoil.

Water management (table 13) 134
Limitations for—Pond reservoir areas; Embankments, dikes, and levees; Features affecting—Drainage, Terraces and diversions, Grassed waterways.

Engineering index properties (table 14) 137
Depth. USDA texture. Classification—Unified, AASHTO. Fragments greater than 3 inches. Percentage passing sieve number—4, 10, 40, 200. Liquid limit. Plasticity index.

Physical and chemical properties of the soils (table 15) 142
Depth. Clay. Moist bulk density. Permeability. Available water capacity. Soil reaction. Shrink-swell potential. Erosion factors. Organic matter.

Soil and water features (table 16) 145
Hydrologic group. Flooding. High water table. Bedrock. Risk of corrosion.

Physical analysis of selected soils (table 17) 148
Size class and particle diameter. Coarse fragments.

Chemical analysis of selected soils (table 18) 150
Reaction. Extractable cations. Cation exchange capacity. Extractable acidity. Aluminum. Base saturation. Organic matter. Calcium carbonate equivalent. Phosphorus.

Engineering index test data (table 19) 152
Classification. Grain-size distribution. Liquid limit. Plasticity index. Moisture density. Specific gravity.

Classification of the soils (table 20) 153
Family or higher taxonomic class.

Foreword

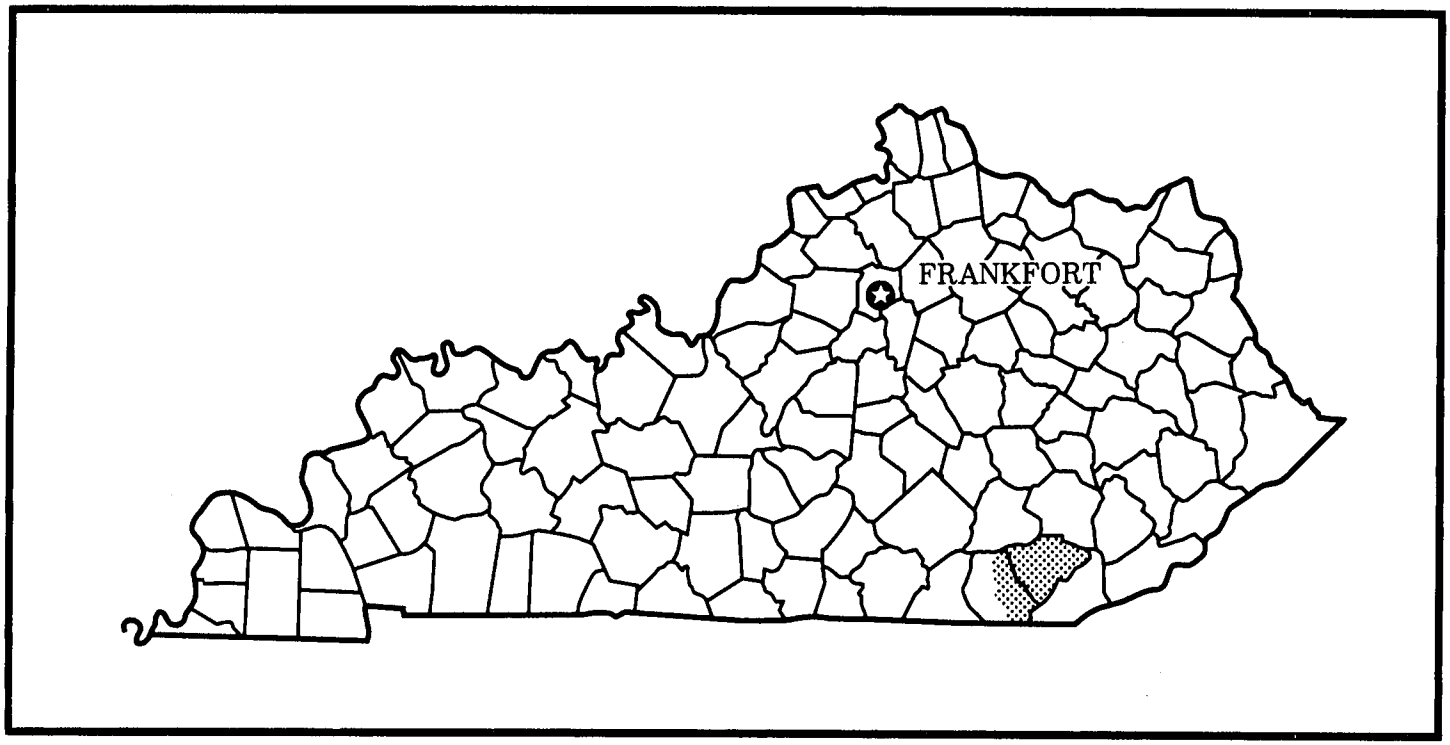
This soil survey contains information that can be used in land-planning programs in Knox County and eastern part of Whitley County, Kentucky. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Randall W. Giessler
State Conservationist
Soil Conservation Service



Location of Knox County and Eastern Part of Whitley County in Kentucky.

Soil Survey of
Knox County and Eastern Part of Whitley County, Kentucky

By Paul M. Love, Soil Conservation Service

Fieldwork by Paul M. Love and Harry S. Evans, Soil Conservation Service, and Dennis L. Lakner, Roy V. Rice, and Jeffrey B. Boyle, Kentucky Natural Resources and Environmental Protection Cabinet

United States Department of Agriculture, Soil Conservation Service
In cooperation with
Kentucky Natural Resources and Environmental Protection Cabinet and
Kentucky Agricultural Experiment Station

The KNOX COUNTY AND EASTERN PART OF WHITLEY COUNTY survey area is made up of all of Knox County and all of Whitley County east of Interstate 75. The survey area is in the southeastern part of Kentucky. Knox County has a total area of about 388 square miles and a population of 29,946. Barbourville, the county seat, has a population of 3,299. The eastern part of Whitley County has a total area of about 217 square miles and includes a major part of the county's population of 32,697. Williamsburg, the county seat, has a population of 5,459. Corbin, the largest town in the survey area, has a population of 7,988. It is in the northwest part of the survey area and is incorporated in both Whitley and Knox Counties *(26)*.

The topography of Knox County and the eastern part of Whitley County generally consists of long, narrow, steep to very steep ridgetops; steep to very steep side slopes; and narrow to broad valleys. Most of the soils formed in material weathered from acid sandstone, siltstone, and shale.

Most of the area is wooded, and farming is generally part time. The major sources of employment are nonagricultural jobs, such as manufacturing, wholesale and retail trade, mining, and service occupations.

Farming is limited mostly to the valleys and ridgetops. The soils in these areas are used for cultivated crops or hay and pasture. The main crops are tobacco and corn. Most of the soils on side slopes are better suited to use as woodland than to other uses. By 1977, about 5 percent of the survey area had been strip-mined for coal.

Knox County joins Clay and Laurel Counties to the north, Whitley County to the west, and Bell County to the south and east. The eastern part of Whitley County joins Laurel County to the north, Knox County to the east, and Campbell County, Tennessee, to the south.

Some of the soil lines on the soil maps of Knox County do not join with those of Laurel County because of differences in the design and composition of the map units. Some of the soil lines on the soil maps of the eastern part of Whitley County do not join with those of the western part of Whitley County, and most names do not correspond. This was caused by changes in the

concepts of series, differences in the design of the map units, and differences in map scale.

General Nature of the Survey Area

This section provides general information about settlement, climate, geology, relief and drainage, farming, and natural resources in the soil survey area.

Settlement

The first settlers came to Knox County in 1750. They were Dr. Thomas Walker and his companions and some surveyors and agents for the Loyall Land Company of Virginia. Some of these settlers built a log cabin, the first house in Kentucky, and spent the winter near the Cumberland River, 6 miles south of the present site of Barbourville. Dr. Walker named both the Cumberland Mountains and Cumberland River for the Duke of Cumberland, a son of King George II of England. Later, pioneers and hunters passed through the area on the Wilderness Road east of Barbourville.

Knox County, named after General Henry Knox, was formed in 1799 from territory taken from Lincoln County, one of the three original Kentucky counties. General Knox was a native of Boston who distinguished himself at the Battle of Bunker Hill in 1775 and became the nation's first Secretary of War. Barbourville was founded in 1800 and was named for James Barbour, who gave land for the town site. Union College has served southeastern Kentucky since its founding in 1879 *(17)*.

In 1800, a population of 1,109 was recorded for Knox County. The population steadily increased, augmented by a land boom in 1888 with the coming of the Louisville and Nashville Railroad and another in 1900 caused by the discovery of oil in the county.

Whitley County was formed in 1818 from territory taken from Knox County. The county was named for Colonel William Whitley, an early Kentucky settler who led troops to protect travelers along the Wilderness Road. Whitley built the oldest brick house west of the Alleghenies in Lincoln County.

Within 2 years after its founding, Whitley County had a population of 2,340. The population steadily increased until the 1840's when there was a rapid expansion because of the area's agriculture and timber resources *(18)*.

Geology, Relief, and Drainage

The survey area lies within the Mountains and Eastern Coal Fields Physiographic Region, which is part of the Cumberland Plateau. The Cumberland Plateau is a maturely dissected plateau of varying altitude and relief *(20)*.

The geology of the survey area consists of the Lower and Middle Pennsylvanian System with the exception of the north side of Pine Mountain overthrust fault (fig. 1). The bedrock of the entire area north of Pine Mountain is the Breathitt Formation and is made up of interbedded acid sandstone, siltstone, and shale. Shelocta and Latham soils are dominant on this formation. On the north side of Pine Mountain, where the Mississippian System is exposed, Bledsoe soil is dominant. This soil formed from the Newman Limestone Formation. The soils on the south side of Pine Mountain are underlain by the Lee Formation of the Lower Pennsylvanian System. Rigley and Lily soils are dominant on this formation.

About 76 percent of the survey area consists of steep to very steep side slopes and irregularly winding, narrow, steep to very steep ridgetops. About 11 percent is nearly level to gently sloping flood plains and terraces. The remaining 13 percent consists of gently sloping to moderately steep ridgetops, alluvial fans, foot slopes, and high stream terraces. Elevations range from about 900 feet along the Cumberland River on the western boundary of the survey area to more than 2,300 feet on a mountain top south of Wheeler near the Bell County line. Elevation generally increases from west to east.

The area is dissected by a dendritic pattern of streams. The Collins Fork watershed, in the north central part of Knox County, flows northward and empties into a tributary of the South Fork of the Kentucky River. The Lynn Camp Creek watershed, in the northwest part of the survey area, empties into the Laurel River about 1/2 mile west of the survey area. The rest of the survey area is drained by the Cumberland River and its tributaries. The Cumberland River bisects the survey area and flows generally westward in a meandering pattern. Major tributaries of the Cumberland River in Knox County are Stinking Creek, Fighting Creek, Richland Creek, Indian Creek, Little Poplar Creek, and Brush Creek. Watts Creek, Clear Fork, Meadow Creek, and Patterson Creek are the major tributaries of the Cumberland River in the eastern part of Whitley County.

Farming

In 1978, about 21.4 percent of the soils in Knox County *(15)* and 15.2 percent in Whitley County *(16)* were used for farming. This was a decrease from 1974 of about 4.5 percent in Knox County and 2.5 percent in Whitley County. In 1978, there were 447 farms in Knox County. This was a decrease from 674 farms in 1969. The size of the average farm in Knox County, however, increased from about 104 acres in 1969 to about 119 acres in 1978. About 50 percent of the land used for farming in Whitley County is in the survey area. In 1978, there were 374 farms in Whitley County. This was a decrease from 581 farms in 1969. The size of the average farm in Whitley County increased from about 105 acres in 1969 to 116 acres in 1978.

According to the U.S. Census of Agriculture, farming was the principal occupation of only 35 percent of the

Figure 1.—Tilted strata of Pine Mountain overthrust fault exposed in a road cut.

farmers in Knox County and 31 percent in Whitley County during the period 1974-1978.

The main farm enterprises in the survey area are row crops, hay, pasture, and livestock. Tobacco is the main cash crop, and beef cattle is the principal livestock enterprise. Much of the farm produce is needed for domestic use and is used by the farm family or fed to livestock.

Farming is diversified in the survey area. Income from crops accounted for 66 percent of all cash receipts in Knox County in 1981. In Whitley County, income from livestock exceeded income from crops and accounted for 58 percent of the total cash receipts *(14)*.

Natural Resources

The major natural resources in the survey area are soil, water, timber, coal, oil, and natural gas. Soil is the most important natural resource. However, steep slopes, wetness, flooding, depth to bedrock, and slow permeability are major problems when using the soils for agriculture, woodland, or community development. Slope

is the dominant limiting soil property in the area for most uses.

The forests are an important natural resource and cover about 78 percent of the survey area. Most of the area has been logged in the past. Logging and wood industries continue to be sources of income, and timber growth in the area exceeds the annual harvest.

Coal is the most profitable natural resource in the survey area. According to the Kentucky Department of Mines and Minerals, the average production of bituminous coal from 1978 through 1982 was 1,479,857 tons per year in Knox County and 2,023,860 tons per year in Whitley County. Most of the coal produced in Whitley County was in the survey area.

Small amounts of oil and natural gas are produced in the area.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Winters are cold and snowy at higher elevations in Knox County and the eastern part of Whitley County. In valleys, it is also frequently cold, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm on mountain slopes and very warm with occasional very hot days in the valleys. Rainfall is evenly distributed during the year, but it is appreciably heavier on the windward, west-facing slopes than in the valleys. Normal annual precipitation is adequate for all crops.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Barbourville, Kentucky, in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 38 degrees F, and the average daily minimum temperature is 25 degrees. The lowest temperature on record, which occurred at Barbourville on January 31, 1966, is -20 degrees. In summer the average temperature is 74 degrees, and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred at Barbourville on September 5, 1954, is 106 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 51 inches. Of this, 26 inches, or 50 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 22 inches. The heaviest 1-day rainfall during the period of record was 4.1 inches at Barbourville on September 29, 1964. Thunderstorms occur on about 47 days each year, and most occur in summer.

The average seasonal snowfall is 15 inches. The greatest snow depth at any one time during the period of record was 16 inches. On an average of 1 day, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

Heavy rains, which occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, particularly in narrow valleys.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or a building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Dominantly Steep and Very Steep, Well drained and Moderately Well Drained, Deep and Moderately Deep Soils; on Uplands

This group consists of soils that are well drained and moderately well drained, deep and moderately deep, and have a loamy surface layer and a loamy or clayey subsoil. The four map units in this group make up about 84 percent of Knox County and about 78 percent of the eastern part of Whitley County. Most of the acreage is used as woodland, but a small acreage, primarily in narrow valleys, is used for pasture and row crops. Steepness of slope on the uplands and the hazard of flooding in the narrow valleys are the main limitations for most uses.

1. Shelocta-Latham-DeKalb

Steep and very steep, well drained and moderately well drained, deep and moderately deep soils; on side slopes and narrow ridgetops

The landscape of this map unit is characterized by steep and very steep, long, winding convex ridgetops that break onto steep and very steep, concave and convex side slopes that are dissected by many intermittent streams that descend to narrow valleys (fig. 2). The intermittent streams join and become branches and creeks that flow through narrow flood plains. Soils in this landscape are underlain by interbedded shale, siltstone, and sandstone bedrock of Pennsylvanian age. Some areas of these soils have been surface mined for coal. Several creeks and many intermittent streams are in this map unit. Embankment and excavated ponds provide water for livestock where flowing water is unavailable. Most roads, farm structures, small communities, and other buildings and houses are in narrow valleys on slopes above the narrow flood plains.

This map unit makes up about 84 percent of Knox County and about 71 percent of the eastern part of Whitley County. In Knox County, the map unit is about 39 percent Shelocta soils, 32 percent Latham soils, 6 percent DeKalb soils, and 23 percent soils of minor extent. In the eastern part of Whitley County, it is about 41 percent Shelocta soils, 30 percent Latham soils, 4 percent DeKalb soils, and 25 percent soils of minor extent.

Shelocta soils formed in colluvium from shale, siltstone, and sandstone. The subsoil is dominantly channery silty clay loam. The soils are deep, well drained, and steep and very steep. They are on smooth, concave side slopes and in coves.

Latham soils formed in residuum from acid shale. The subsoil is silty clay loam or clay. The soils are moderately deep, moderately well drained, and steep and very steep. They are on convex side slopes and narrow ridgetops.

DeKalb soils formed in residuum from sandstone. The subsoil is dominantly very channery fine sandy loam. The soils are moderately deep, well drained, and steep and very steep. They are on narrow ridgetops and upper side slopes.

Of minor extent are the Bethesda, Fairpoint, Lily, Pope, Steinsburg, Stendal, Stokly, and Wernock soils. The Fairpoint and Bethesda soils are in areas that have been surface mined. The Lily, Steinsburg, and Wernock soils are on upper convex side slopes and ridgetops. The Pope, Stendal, and Stokly soils are in valleys.

Most soils of this map unit are used mainly as woodland. In some areas, they are used as pasture. Small acreages are in row crops and gardens.

The soils of this map unit have limited potential for farming. In most of the cleared areas on the steep and very steep side slopes, the soils are used as pasture. Pastures are hard to establish and maintain, however, because the slopes are steep and erosion is a very severe hazard. Farming is mostly limited to the narrow valleys.

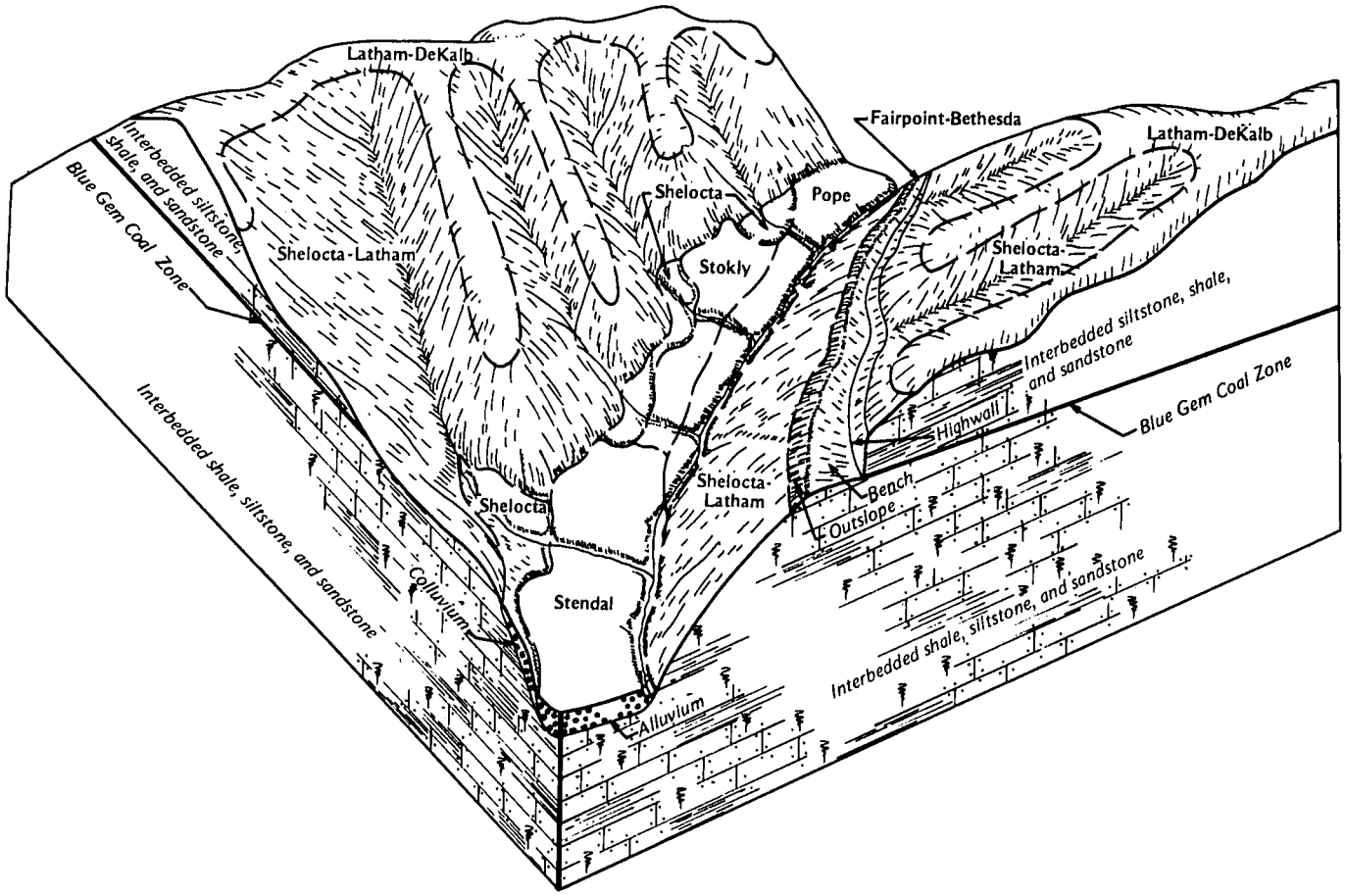


Figure 2.—Pattern of soils, topography, and underlying material in the Shelocta-Latham-DeKalb map unit.

The soils are suited to use as woodland. Productivity is moderate to low on the ridgetops and high to moderate on the side slopes. On the ridgetops, the woodland is dominantly chestnut oak, Virginia pine, hickory, black oak, and scarlet oak. Common trees on the side slopes are yellow-poplar, white oak, black oak, red maple, Virginia pine, and shortleaf pine. Yellow-poplar is dominant on the Shelocta soils on north- and east-facing side slopes and in coves. Productivity is high on these soils. The very severe erosion hazard and equipment use limitations are management problems. Plant competition is a problem on the deep Shelocta soils.

In most areas, the soils of this map unit are poorly suited to urban and recreational uses because of steep side slopes and flooding in narrow valleys. If Shelocta soils are undercut for roads or buildings, they are susceptible to landslides.

The soils of this map unit are suited to use as habitat for openland and woodland wildlife.

2. Rigley-Lily-Shelocta

Very steep to moderately steep, well drained, deep and moderately deep soils; on side slopes and ridgetops

The soils of this map unit are on the south side of Pine Mountain in southeastern Whitley County. The landscape is characterized by moderately steep and steep, long, convex ridgetops and upper side slopes abruptly breaking onto steep and very steep side slopes in deep ravines (fig. 3). The ravines are dissected by intermittent streams and descend to the canyon of Laurel Fork, where entrenched meanders are flanked by cliffs of sandstone. Soils in this landscape are underlain by conglomerate sandstone, siltstone, and shale bedrock of the Lee Formation from the Lower Pennsylvanian System. Slopes range from 12 to 60 percent, but they dominantly are 12 to 30 percent on ridgetops and 30 to 60 percent on side slopes. The only access to the area is one unpaved private road. A power line and buildings

on an abandoned farmstead constitute the only structures. This area is not inhabited by man.

This map unit is not in Knox County, but it makes up about 2 percent of the eastern part of Whitley County. It is about 32 percent Rigley soils, 22 percent Lily soils, 19 percent Shelocta soils, and 27 percent soils of minor extent.

Rigley soils formed in colluvium mostly from acid sandstone and siltstone. The subsoil is dominantly loam or channery loam. The soils are deep, well drained, and steep and very steep soils. They are on side slopes, in deep ravines, and directly below Rock outcrops.

Lily soils formed in acid sandstone residuum. The subsoil is dominantly sandy clay loam or clay loam. The soils are moderately deep, well drained, and moderately steep and steep. They are on long, convex ridges and upper side slopes.

Shelocta soils formed in colluvium from acid sandstone, siltstone, and shale. The subsoil is dominantly channery silty clay loam. The soils are deep,

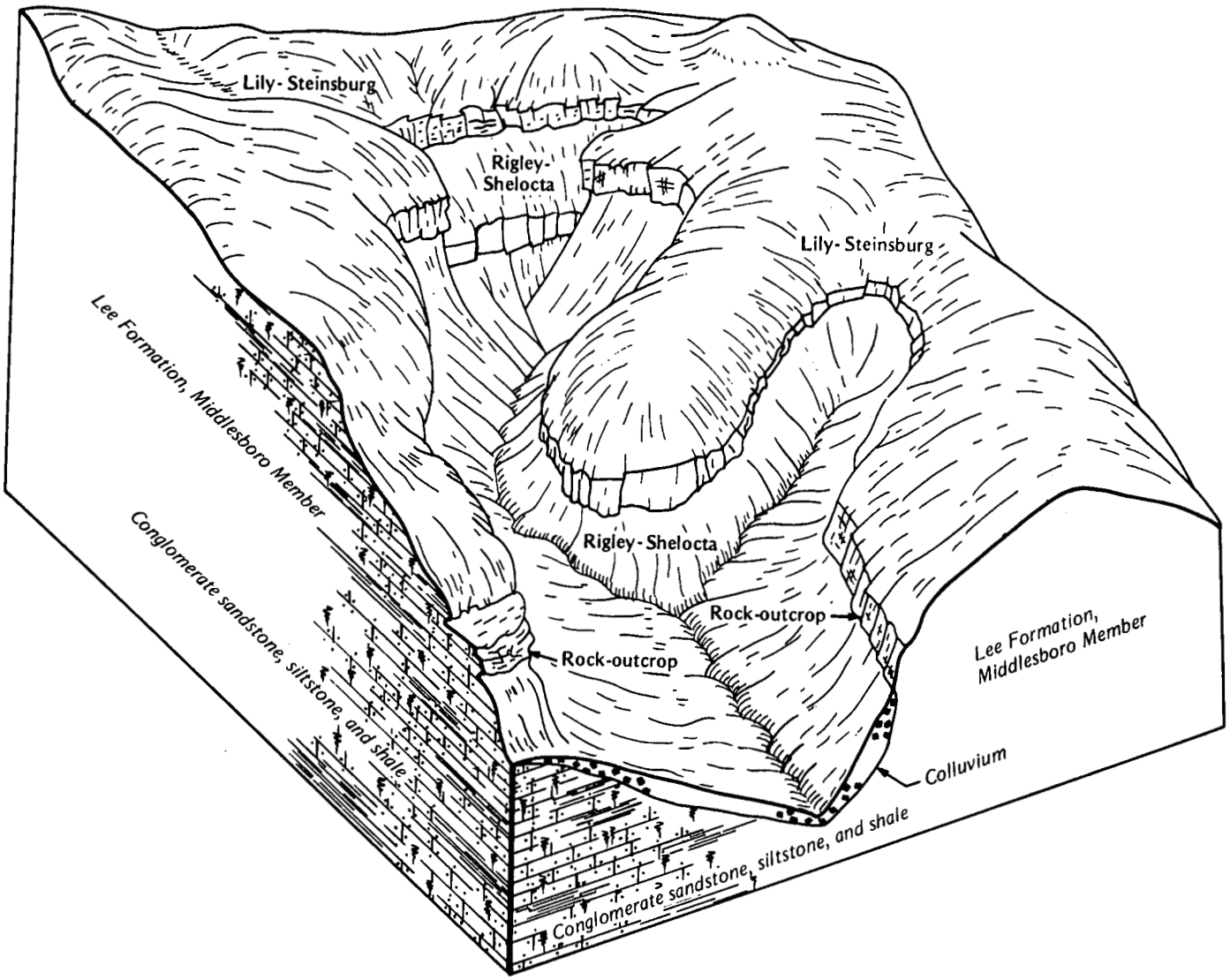


Figure 3.—Pattern of soils, topography, and underlying material in the Rigley-Lily-Shelocta map unit.

well drained, and steep and very steep. They are on smooth, concave side slopes and in coves.

Of minor extent in this map unit are Steinsburg, Wernock, and DeKalb soils on convex ridgetops and points. Rock outcrops occur near the top of the ravines and on ridgetops.

Except for one small tract in pasture, all of the soils of this map unit are used as woodland.

The soils of this map unit are poorly suited to farming. Most areas are inaccessible to modern machinery. Steep slopes, rock outcrops, and large stones, and the hazard of erosion are also severe limitations.

These soils are suited to woodland. On the convex ridgetops, the woodland is dominantly chestnut oak, Virginia pine, black oak, hickory, shortleaf pine, and red maple. Hemlock and yellow-poplar are the dominant trees in the deep ravines. Productivity is high to moderate. The main concerns in woodland management are the severe erosion hazard and equipment limitations. Plant competition is a problem on the Rigley and Shelocta soils.

Although this area is spectacularly senic, the soils of this map unit have severe limitations for urban and recreational uses. Steepness of slope, rock outcrops, and large stones are the main limitations. The Rigley and Shelocta soils are susceptible to landslides if they are undercut for roads or buildings. Most areas are relatively inaccessible.

These soils are well suited to use as habitat for woodland and wildlife.

3. Shelocta-Latham

Very steep to sloping, well drained and moderately well drained, deep and moderately deep soils; on side slopes and ridgetops

The landscape of this map unit is characterized by sloping to moderately steep, narrow ridgetops that gradually break onto steep and very steep, short, smooth side slopes (fig. 4). Slopes range from 6 to 60 percent but dominantly are 30 to 60 percent on side slopes and 6 to 12 percent on ridgetops. Soils in this landscape are underlain by interbedded siltstone, shale, and sandstone bedrock of Pennsylvanian age. Some areas of these soils have been surface mined for coal. A few farm related structures are in the area. Most roads and houses are in narrow valleys on lower side slopes or on ridgetops.

This map unit is not in Knox County, but it makes up about 4 percent of the eastern part of Whitley County. It is about 48 percent Shelocta soils, 32 percent Latham soils, and 20 percent soils of minor extent.

Shelocta soils formed in colluvium from shale, siltstone, and sandstone. The subsoil is dominantly channery silty clay loam. The soils are deep, well drained, and steep and very steep. They are on short, smooth, concave side slopes.

Latham soils formed in residuum from acid shale. They have a silty clay loam, silty clay, or clay subsoil. The soils are moderately deep, moderately well drained, and sloping to very steep. They are on convex side slopes and ridgetops.

Of minor extent in this map unit are Fairpoint and Bethesda soils in strip-mined areas on upper side slopes and ridgetops. Small areas of Wernock and Lily soils also occur on narrow, convex ridgetops, and Stendal and Cuba soils are along narrow drainageways on flood plains.

Most of the soils of this map unit are used as woodland. In a few areas, they are used as pasture and hay. Corn and garden crops are grown in small patches in the hollows and on a few ridgetops.

The soils of this map unit have limited suitability for farming. The Shelocta and Latham soils on the steep to very steep side slopes are not suited to row crops. Pastures are difficult to establish and maintain. Erosion is a very severe hazard on these soils. The dominantly sloping Wernock, Lily, and Latham soils on narrow ridgetops are suited to row crops and pasture; however, erosion is a severe hazard.

The soils of this map unit are suited to use as woodland. Productivity is high to moderate on the steep to very steep side slopes and high to low on the ridgetops. On the steep and very steep side slopes, erosion is a severe hazard and equipment limitations are management problems. Plant competition is a problem on the Shelocta soils.

Because of steepness of slope, most soils of this map unit are poorly suited to urban and recreational uses. The Shelocta soils are susceptible to landslides if they are undercut for construction of roads or buildings.

The soils are suitable for use as habitat for openland and woodland wildlife.

4. Shelocta-Bledsoe-Steinsburg

Very steep to moderately steep, well drained, deep and moderately deep soils; on side slopes and benches

The soils of this map unit are on the north side of Pine Mountain in southeastern Whitley County. The landscape, which was formed by the Pine mountain overthrust fault, is characterized by moderately steep to very steep side slopes and benches intermingled with Rock outcrops that are dissected by intermittent streams (fig. 5). Most of the area is stony or bouldery. Soils in this landscape are underlain by sandstone, siltstone, shale, and limestone of Pennsylvanian and Mississippian ages. Slopes range from 15 to 90 percent but dominantly are from 50 to 85 percent. This map unit includes many intermittent streams, a few logging roads, and one paved road. The area is not inhabited by man.

This map unit is not in Knox County, but it makes up about 1 percent of the eastern part of Whitley County. It is about 30 percent Shelocta soils, 22 percent Bledsoe

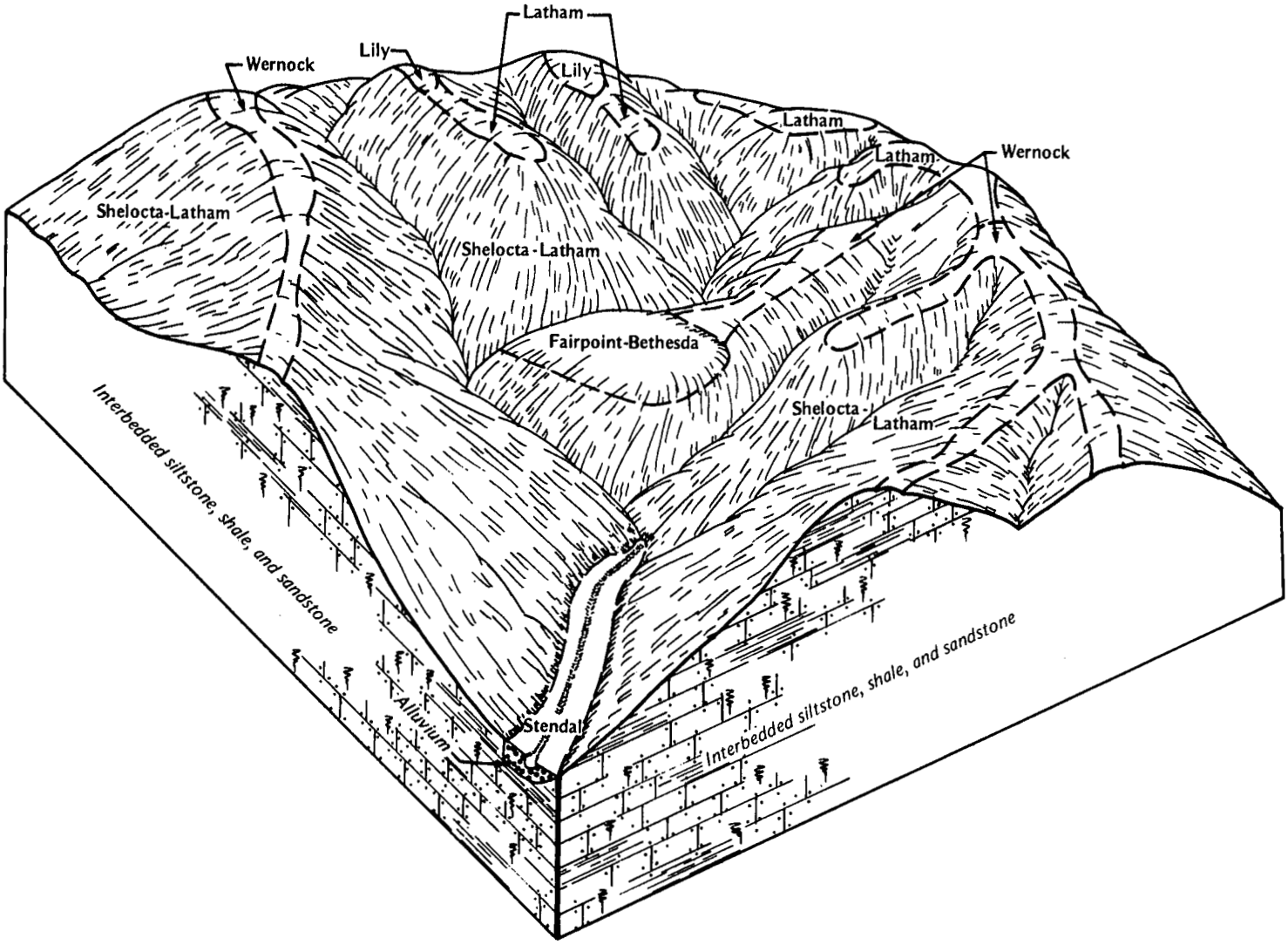


Figure 4.—Pattern of soils, topography, and underlying material in the Shelocta-Latham map unit.

soils, 22 percent Steinsburg soils, and 26 percent Rock outcrops and minor soils.

Shelocta soils formed in colluvium from acid sandstone, siltstone, and shale. The subsoil is dominantly channery silty clay loam. The soils are deep, well drained, and moderately steep to very steep. They are on smooth, concave side slopes, benches, and in coves.

Bledsoe soils formed in colluvium primarily from limestone. The subsoil is dominantly silty clay loam or silty clay. The soils are deep, well drained, and moderately steep to very steep. They are on smooth, concave side slopes and benches directly below limestone Rock outcrops.

Steinsburg soils formed in acid sandstone residuum. The subsoil is fine sandy loam. The soils are moderately deep, well drained, and steep and very steep. They are on convex upper side slopes.

Rock outcrop, which is mapped in a complex with Steinsburg and Shelocta soils and also in a complex with Bledsoe and Shelocta soils, makes up about 13 percent of the map unit. Soils of minor extent and stones and boulders make up the remaining 13 percent. Of minor extent are the Latham, Lily, and Rigley soils on side slopes.

The soils of this map unit are used as woodland. The natural vegetation is mixed hardwoods and pines.

The soils of this map unit are not suited to cultivated crops or hay and pasture because of steepness of slope, Rock outcrops, and boulders.

These soils are well suited to use as woodland. On the convex upper slope, the woodland is dominantly

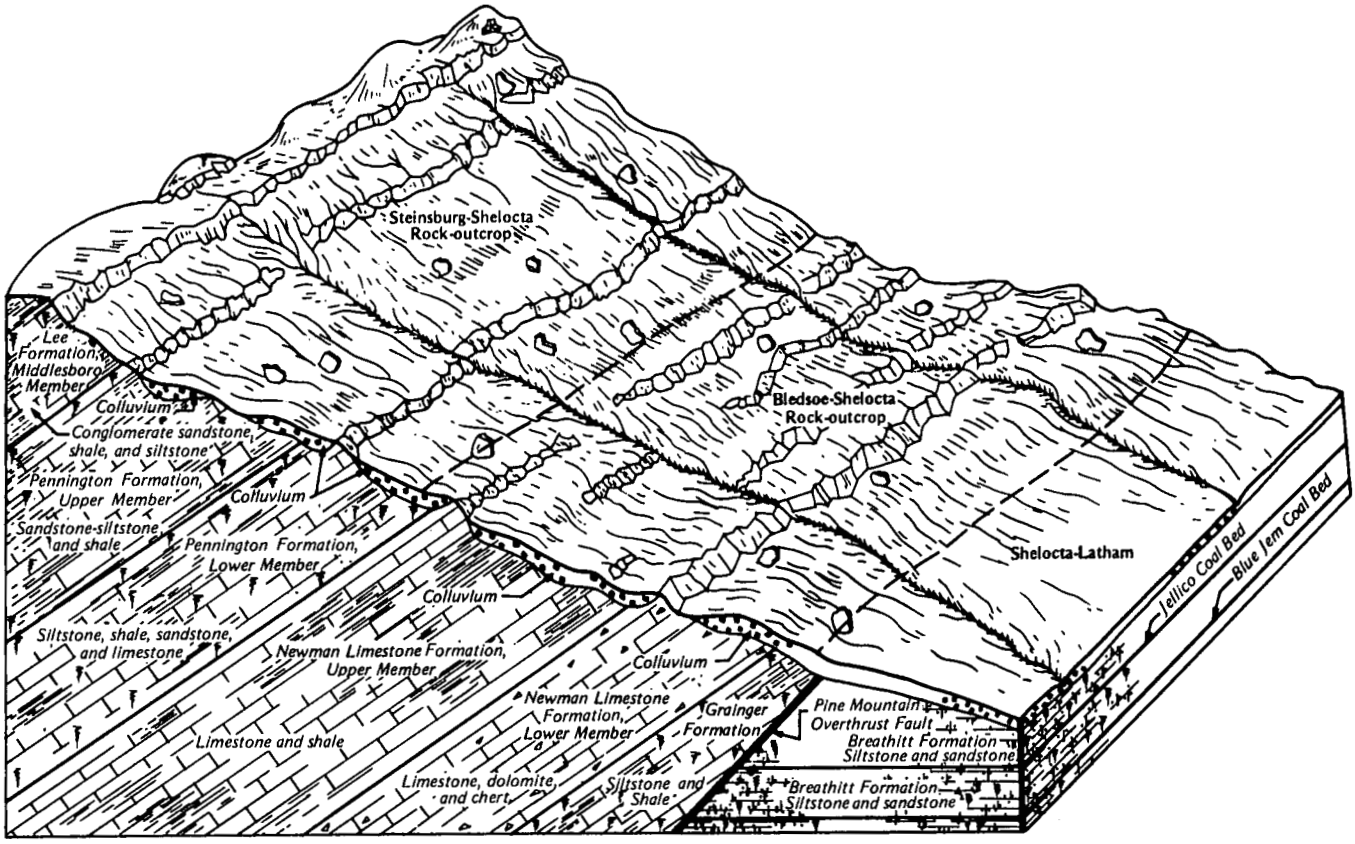


Figure 5.—Pattern of soils, topography, and underlying material in the Shelocta-Bledsoe-Steinsburg map unit.

chestnut oak, Virginia pine, and red maple. Yellow-poplar and white oak are the dominant trees on the smooth, concave slopes and in coves. Productivity is very high on the Bledsoe soils, high on the Shelocta soils, and moderate on the Steinsburg soils. The main concerns in woodland management are the severe erosion hazard and equipment limitations. Plant competition is a management problem on Bledsoe and Shelocta soils.

These soils have very severe limitations for urban and recreational uses because of steepness of slope, Rock outcrops, and stony surfaces. The Shelocta and Bledsoe soils are susceptible to landslides if they are undercut for construction of roads or buildings.

The soils of this map unit are well suited to use as habitat for woodland wildlife.

Dominantly Nearly Level to Moderately Steep, Well Drained to Somewhat Poorly Drained, Deep Soils; In Valleys

This group consists of soils that are well drained to somewhat poorly drained and deep. The soils have a loamy surface layer and subsoil. The three map units in this group make up about 10 percent of Knox County and about 16 percent of the eastern part of Whitley County. Most of the acreage is used for cultivated crops and hay and pasture. Scattered tracts are used as woodland. Some areas of these soils that do not flood or rarely flood are used for residential development. Flooding and wetness are the main limitations for most uses.

5. Stendal-Shelocta

Nearly level to moderately steep, somewhat poorly drained and well drained, deep soils; on flood plains, alluvial fans, and foot slopes

The landscape of this map unit is characterized by nearly level flood plains and gently sloping to moderately steep colluvial foot slopes and alluvial fans (fig. 6). Slopes range from 0 to 20 percent but are 0 to 2 percent on the flood plains and dominantly 2 to 12 percent on the colluvial foot slopes and alluvial fans. Soils in this landscape are underlain by interbedded shale,

sandstone, and siltstone of Pennsylvanian age. Several creeks and many branches as well as many small communities and farmsteads are in this map unit. Roads, houses, and farm buildings constitute the important structures. Most roads, houses, and farm related structures are on foot slopes and alluvial fans above the flood plains. This area is highly populated.

This map unit makes up about 4 percent of Knox County and about 6 percent of the eastern part of Whitley County. In Knox County, the map unit is about 60 percent Stendal soils, 30 percent Shelocta soils, and 10 percent soils of minor extent. In Whitley County, it is about 60 percent Stendal soils, 30 percent Shelocta soils, and 10 percent soils of minor extent.

Stendal soils formed in recent alluvium. The subsoil is silt loam. The soils are somewhat poorly drained and nearly level. They are on flood plains.

Shelocta soils formed in colluvium. The subsoil is silty clay loam and gravelly silty clay loam. The soils are well drained and gently sloping to moderately steep. They are on alluvial fans and colluvial foot slopes.

Of minor extent in this map unit are Bonnie, Cuba, Stokly, and Pope soils on flood plains and Morehead, Whitley, and Cotaco soils on stream terraces.

Most of the soils of this map unit are cleared and used for farming. Pasture, hay, and row crops are the main uses. Many small areas of the Shelocta soils are used for home sites, gardens, or tobacco. Some areas are idle, or the soils are used as woodland.

The soils of this map unit are suited to most cultivated crops and pasture, but erosion is a hazard on the Shelocta soils, and wetness and the hazard of flooding are limitations to the use of Stendal soils. Artificial drainage of the Stendal soils can help to overcome the wetness limitation.

This map unit is well suited to use as woodland, and productivity is high on these soils. The main concerns in woodland management are plant competition on both soils and equipment use on the Stendal soils.

Stendal soils are poorly suited to urban and recreational uses because of wetness and flooding. Shelocta soils are well suited to most urban and recreational uses where slope is not a limitation.

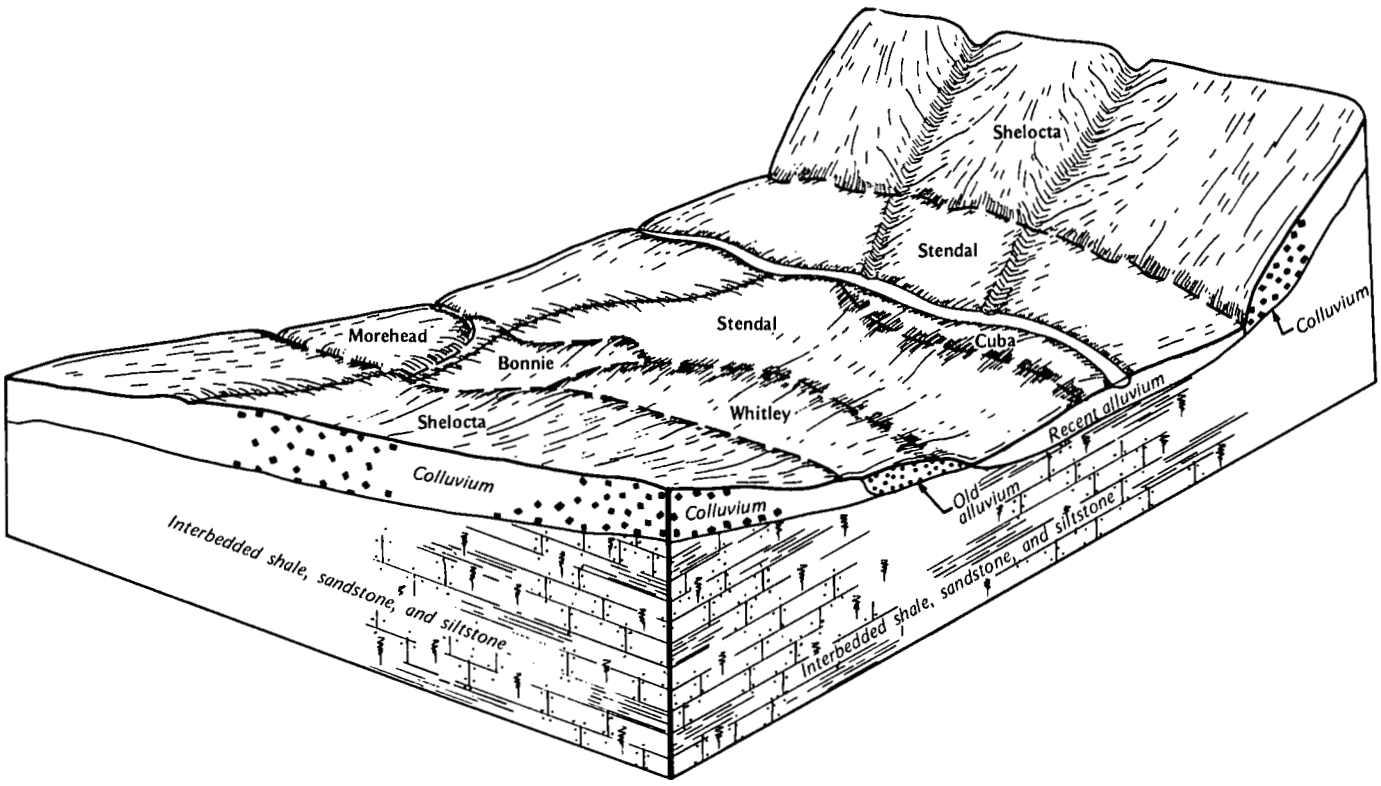


Figure 6.—Pattern of soils, topography, and underlying material in the Stendal-Shelocta map unit.

Stendal soils are well suited to use as habitat for woodland wildlife and fairly well suited to use as habitat for openland wildlife. Shelocta soils are well suited to use as habitat for both woodland and openland wildlife.

6. Allegheny-Huntington-Newark

Nearly level to moderately steep, well drained and somewhat poorly drained, deep soils, on stream terraces and flood plains

The landscape of this map unit is characterized by broad, nearly level to moderately steep terraces and nearly level flood plains in wide valleys along the Cumberland River (fig. 7). Many intermittent streams dissect the terraces and flood plains. Soils in this landscape are underlain by interbedded shale, siltstone, and sandstone of Pennsylvanian age. Slopes range from 0 to 20 percent but dominantly are 2 to 12 percent on terraces and 0 to 2 percent on flood plains. The Cumberland River, the lower part of several creeks, and many intermittent streams are in this map unit. Embankment and excavated ponds provide water for livestock where flowing water is not available. Roads, railroads, houses, industrial sites, and farm and urban buildings are the important structures. These structures generally are located in areas of soils that do not flood or rarely flood.

This map unit makes up about 6 percent of Knox County, but it is not in Whitley County. The map unit is about 33 percent Allegheny and similar soils, 17 percent Huntington soils, 9 percent Newark soils, and 41 percent soils of minor extent.

Allegheny soils formed in loamy alluvium from acid sandstone, siltstone, and shale. The subsoil is dominantly loam or clay loam. The soils are deep, well drained, and nearly level to moderately steep. They are on high and low terraces and alluvial fans.

Huntington soils formed in alluvium. The surface layer is thick and dark, and the subsoil is silt loam. The soils are deep, well drained, and nearly level. They are on flood plains along the Cumberland River.

Newark soils formed in alluvium. The subsoil is dominantly silt loam. The soils are deep, somewhat

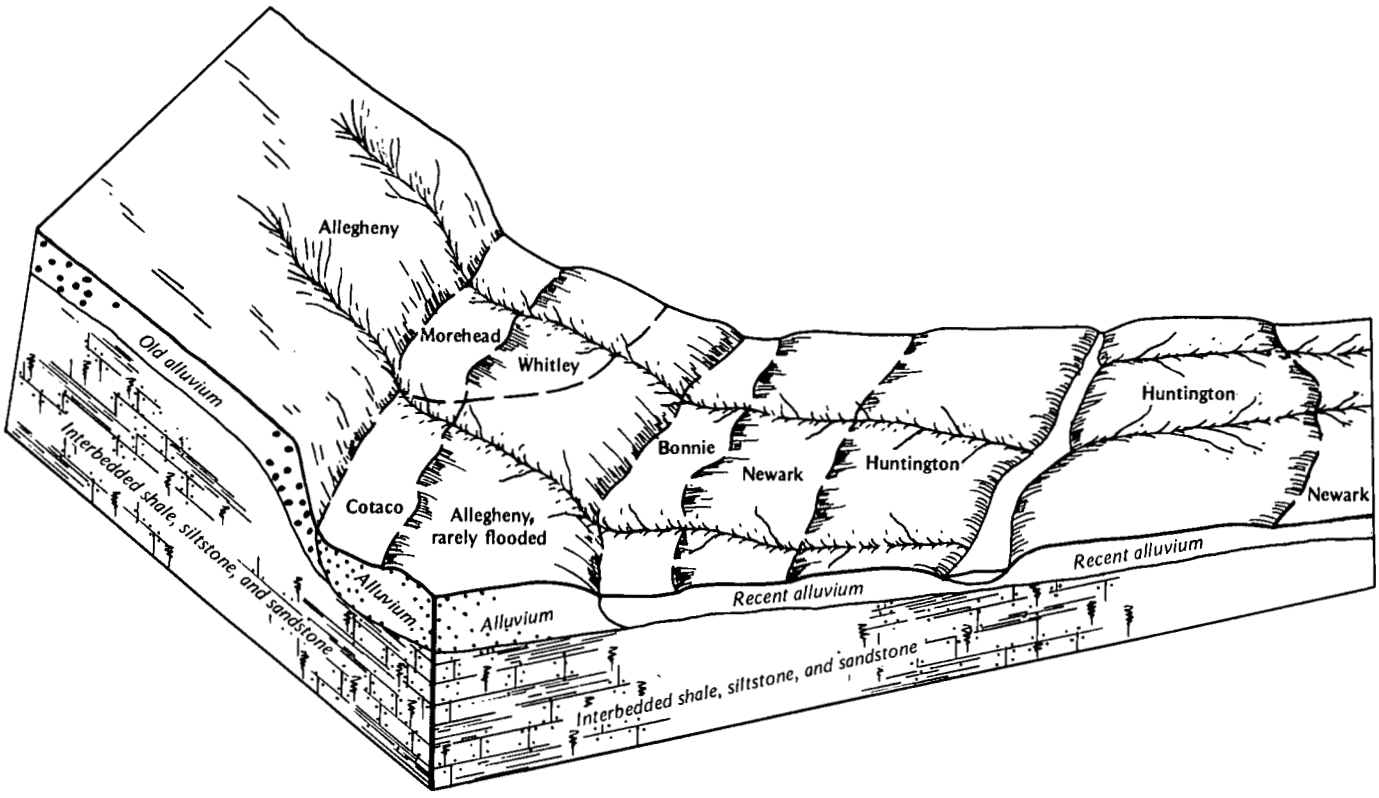


Figure 7.—Pattern of soils, topography, and underlying material in the Allegheny-Huntington-Newark map unit.

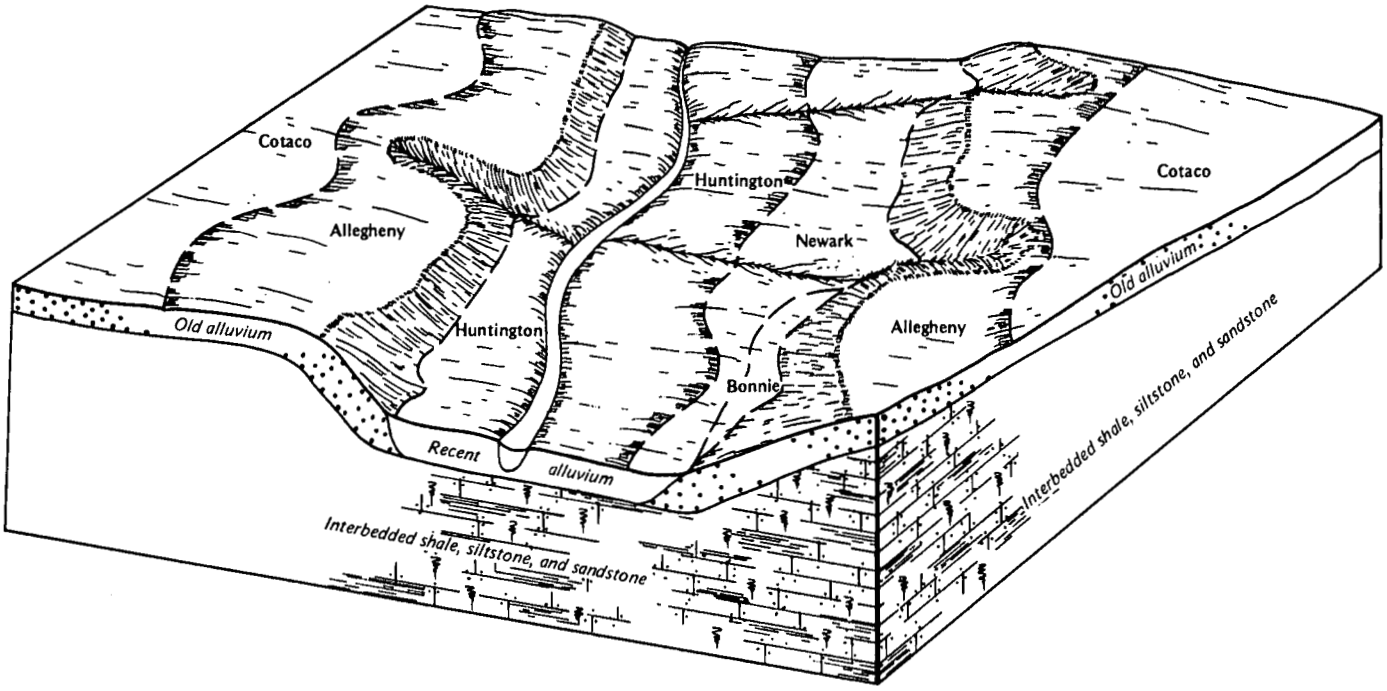


Figure 8.—Pattern of soils, topography, and underlying material in the Allegheny-Cotaco-Huntington map unit.

poorly drained, and nearly level. They are on flood plains along the Cumberland River.

Of minor extent are the Bonnie, Stendal, and Stokly soils on flood plains; the Morehead and Cotaco soils on stream terraces; the Shelocta soils on foot slopes and alluvial fans; and the Latham and Wernock soils on low ridges.

Most of the soils of this map unit have been cleared and are used for row crops or pasture and hay. Scattered tracts of mixed hardwoods and pines generally are in wetter areas.

In nonurban areas, the Allegheny and Huntington soils are well suited to farming, and if drained, the Newark soils are also well suited. Tile drainage is commonly used to reduce wetness of the Newark soils.

Although most of the acreage is cleared, the soils of this map unit are well suited to use as woodland.

The Allegheny soils are well suited to urban uses where flooding is not a problem. The Huntington soils are poorly suited because of flooding, and the Newark soils have severe limitations because of occasional flooding and wetness.

Allegheny soils that are gently sloping to sloping and do not flood are well suited to intensive recreational uses. The main limitations of the other soils of this map unit are flooding and wetness.

The soils of this map unit are well suited to use as habitat for openland and woodland wildlife.

7. Allegheny-Cotaco-Huntington

Nearly level to moderately steep, well drained to somewhat poorly drained, deep soils; on stream terraces and flood plains

The landscape of this map unit is characterized by broad, nearly level to moderately steep terraces and nearly level flood plains in wide valleys along the Clear Fork and Cumberland River (fig. 8). Many intermittent streams dissect the terraces and flood plains. Soils in this landscape are underlain by interbedded shale, siltstone, and sandstone of the Pennsylvanian age. Slopes range from 0 to 20 percent, but dominantly are 2 to 12 percent on terraces and 0 to 2 percent on flood plains. The Cumberland River, all of Clear Fork, the lower part of several creeks, and many intermittent streams and branches are in this map unit. Embankment and excavated ponds provide water for livestock where flowing water is unavailable. Roads, railroads, houses, industrial sites, and farm and urban buildings are the important structures. These structures generally are located in areas of soils that do not flood or rarely flood.

This map unit is not in Knox County, but it makes up about 10 percent of the eastern part of Whitley County.

It is about 33 percent Allegheny and similar soils, 14 percent Cotaco and similar soils, 9 percent Huntington soils, and 44 percent soils of minor extent.

Allegheny soils formed in loamy alluvium from acid sandstone, siltstone, and shale. The subsoil is dominantly loam or clay loam. The soils are deep, well drained, and nearly level to moderately steep. They are on high and low terraces and alluvial fans.

Cotaco soils formed in alluvium from acid sandstone, siltstone, and shale. The subsoil is dominantly sandy clay loam. The soils are deep, somewhat poorly drained to moderately well drained, and nearly level. They are on stream terraces and alluvial fans.

Huntington soils formed in alluvium. They have a thick, dark surface layer and a silt loam subsoil. The soils are deep, well drained, and nearly level. They are on flood plains along the Clear Fork and Cumberland River.

Of minor extent in this map unit are Newark, Bonnie, Stendal, and Stokly soils on flood plains; Morehead and Whitley soils on stream terraces; Shelocta soils on foot slopes and alluvial fans, and Latham and Wernock soils on low ridges. A few surface mined areas of Fairpoint and Bethesda soils are along the Clear Fork.

Most of the soils of this map unit have been cleared and are used for row crops and pasture and hay. Scattered tracts of mixed hardwoods and pines are generally in wetter areas. Some areas along the Clear Fork have been surface mined for coal.

In non-urban areas, the Allegheny and Huntington soils are well suited to farming. If drained, the Cotaco soils are also well suited to farming. Tile drainage is commonly used to reduce the wetness of Cotaco soils.

The soils of this map unit are well suited to use as woodland but most of the acreage is cleared.

The Allegheny soils are well suited for urban uses where flooding is not a problem. Huntington soils are poorly suited because of occasional flooding. Cotaco soils have severe limitations caused by rare flooding and by wetness.

Allegheny soils that are gently sloping to sloping and do not flood are well suited to intensive recreational uses. The main limitations of the other soils of this map unit are wetness and the hazard of flooding.

The soils of this map unit are well suited to use as habitat for openland and woodland wildlife.

Dominantly Gently Sloping to Steep, Well Drained and Moderately Well Drained, Moderately Deep and Deep Soils; on Upland Plateaus

This group consists of soils that are well drained and moderately well drained and moderately deep and deep. The soils have a loamy surface layer and a loamy or clayey subsoil. The map unit in this group makes up about 6 percent of Knox County and about 6 percent of the eastern part of Whitley County. The major soils in this group are the Wernock, Shelocta, and Latham soils.

8. Wernock-Shelocta-Latham

Gently sloping to very steep, well drained and moderately well drained, moderately *deep and deep soils; on ridgetops and side slopes*

The landscape of this map unit is characterized by moderately wide, gently sloping to moderately steep, smooth, convex upland ridgetops that break onto sloping to very steep, short, smooth side slopes (fig. 9). Slopes range from 2 to 60 percent, but they are dominantly 2 to 12 percent on ridgetops and 12 to 30 percent on side slopes. Soils in this landscape are underlain by interbedded siltstone, sandstone, and shale bedrock of the Pennsylvanian age. Some areas of these soils have been surface mined for coal. A few creeks and many intermittent streams are in this map unit. Embankment and excavated ponds provide water for livestock. About 30 percent of the area is urban and built-up land. Roads, railroads, industrial sites, and farm and urban buildings constitute the important structures.

The map unit is about 35 percent Wernock soils, 30 percent Shelocta soils, 25 percent Latham soils, and 10 percent soils of minor extent.

Wernock soils formed in residuum from acid sandstone, siltstone, and shale. The subsoil is silt loam and silty clay loam. The soils are moderately deep, well drained, and gently sloping to moderately steep. They are on smooth, convex ridgetops.

Shelocta soils formed in colluvium from shale, siltstone, and sandstone. The subsoil is dominantly channery silty clay loam. The soils are deep, moderately well drained, and sloping to very steep. They are on convex side slopes.

Latham soils formed in residuum from acid shale. The subsoil is silty clay loam or clay. The soils are moderately deep, moderately well drained, and sloping to very steep. They are on narrow ridgetops and side slopes.

Of minor extent in this map unit are the Lily and Clarkrange soils on ridgetops; the Morehead and Cotaco soils on terraces; and the Stendal and Pope soils on narrow flood plains.

Most of the soils of this map unit have been cleared and are used as pasture and hay. A small acreage is in row crops. The uncleared acreage of this map unit generally consists of soils that are steep and very steep or of wet areas. The woodlands are in mixed hardwoods and pines.

The nearly level to sloping soils of this map unit are well suited to cultivated crops. Small acreages of these soils are in corn or tobacco. These soils are also suited to such specialty crops as vegetables. The hazard of erosion is the main limitation to farming. The sloping to very steep Shelocta and Latham soils are well suited to use as pasture.

The soils of this map unit are well suited to use as woodland, but most areas of these soils have been

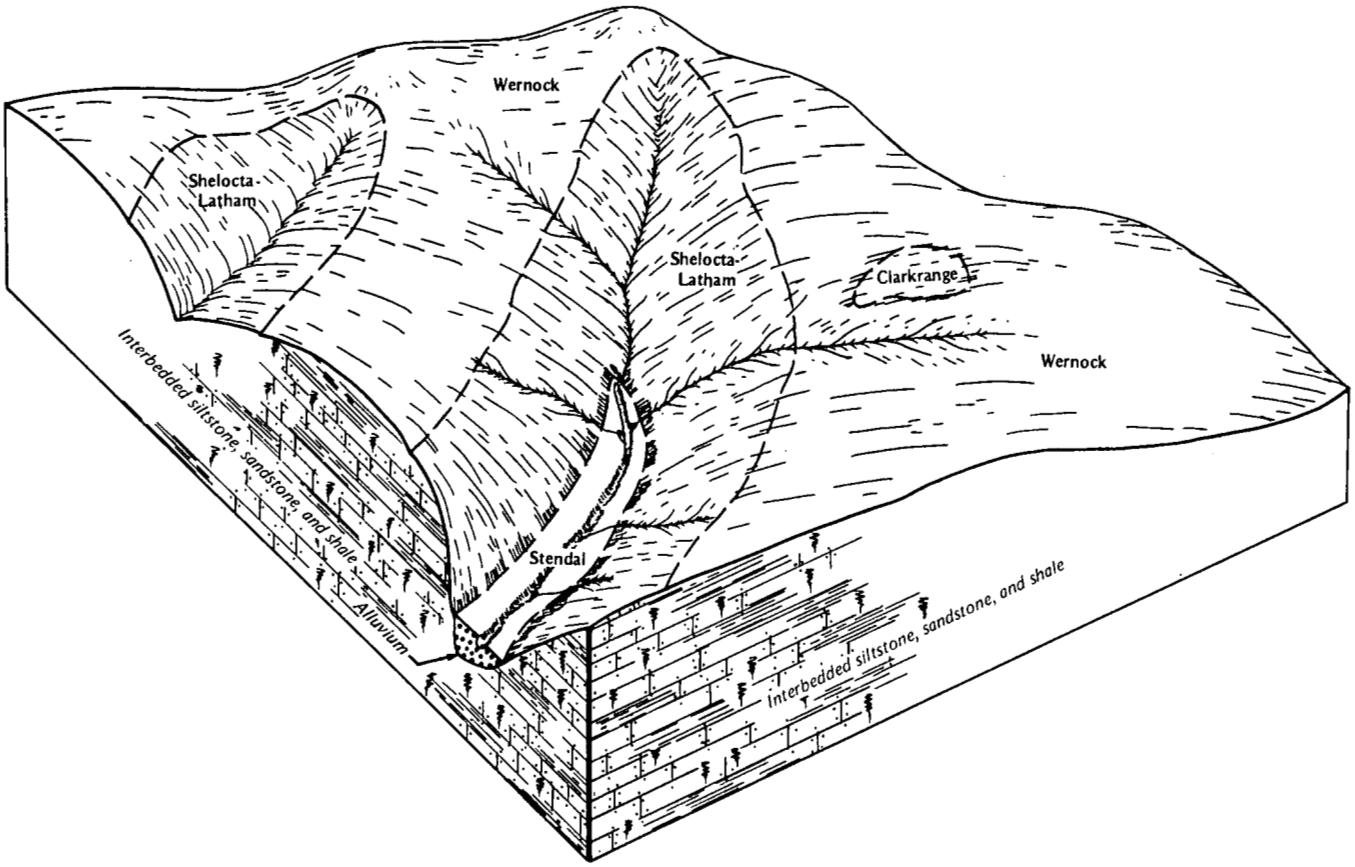


Figure 9.—Pattern of soils, topography, and underlying material in the Wernock-Shelocta-Latham map unit.

cleared. Plant competition is a concern in management on the Wernock and Shelocta soils.

Wernock soils that are gently sloping to sloping are suited to most urban uses. Depth to rock is the main limitation. Low strength is a limitation for local roads and streets. Latham soils have severe limitations for urban use because of slope and the slow or very slow permeability. Slope is also a severe limitation on the Shelocta soils. The steep and very steep Shelocta soils are susceptible to landslides if undercut for roads or buildings.

Wernock soils are suited to most recreational uses, but slope is a severe limitation on the moderately steep to very steep Shelocta and Latham soils.

These soils are suited to use as habitat for openland and woodland wildlife.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Allegheny loam, 2 to 6 percent slopes is one of several phases in the Allegheny series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Latham-DeKalb complex, 30 to 60 percent slopes is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Fairpoint and Bethesda soils, 0 to 20 percent slopes is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits-Dumps complex is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

AlB—Allegheny loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on high stream terraces along the Cumberland River throughout the survey area and along the Clear Fork in Whitley County. Slopes are smooth and convex. Individual areas are 2 to 15 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil, which extends to a depth of about 54 inches, is yellowish brown and strong brown loam in the upper part, and in the lower part, it is strong brown clay loam that has red and light red mottles. The substratum to a depth of about 94 inches is reddish yellow clay loam that has mottles in shades of brown, yellow, red, and white.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Wernock and Latham soils and a soil that is redder throughout the profile than the Allegheny soil but is otherwise similar. Also included are a few small areas of a soil similar to Allegheny soil but is less than 5 feet deep to bedrock. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 2 acres.

This soil is used mainly for row crops, hay, or pasture. In many areas, it is used for homesites and gardens.

This soil is well suited to row crops and produces high yields if properly managed. Crops respond well to fertilizer and lime. Erosion is a moderate hazard, and measures to control it are needed if the soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture and produces high yields if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 129 cubic feet per acre. Preferred trees for planting are eastern white pine, yellow-poplar, black walnut, shortleaf pine, white ash, white oak, and northern red oak. Plant competition is a concern in management.

This soil is well suited to most urban uses.

This Allegheny soil is in capability subclass IIe.

AlC—Allegheny loam, 6 to 12 percent slopes. This soil is deep, well drained, and sloping. it is on high stream terraces along the Cumberland River throughout the survey area and along Clear Fork in Whitley County. Slopes are smooth and convex. Individual areas are 2 to 20 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil, which extends to a depth of about 54 inches, is yellowish brown and strong brown loam in the upper part, and in the lower part, it is strong brown clay loam that has red and light red mottles. The substratum to a depth of about 94 inches is reddish yellow clay loam that has mottles in shades of brown, yellow, red, and white.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Wernock and Latham soils and a soil that is redder throughout the profile than Allegheny soil but is otherwise similar. Also included are a few small areas of a soil that is similar to Allegheny soil but is less than 5 feet deep to bedrock. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 2 acres.

This Allegheny soil is used mainly as pasture or hay. In some small areas, this soil is used for row crops, and in others, it is used as homesites.

This soil is suited to cultivated crops, which respond well to fertilizer and lime. Erosion is a severe hazard, and measures to control it are needed if the soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture and produces high yields if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 129 cubic feet per acre. Preferred trees for planting are eastern white pine, yellow-poplar, black walnut, shortleaf pine, white ash, white oak, and northern red oak. Plant competition is a concern in management.

This soil is suited to most urban uses, but slope is a moderate limitation for building sites and sanitary facilities.

This Allegheny soil is in capability subclass IIIe.

AlD—Allegheny loam, 12 to 20 percent slopes. This soil is deep, well drained, and moderately steep. It is on high stream terraces along the Cumberland River throughout the survey area and along the Clear Fork in Whitley County. Slopes are concave and smooth. Individual areas are 2 to 20 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil, which extends to a depth of about 54 inches, is yellowish brown and strong brown loam in the upper part, and in the lower part, it is strong brown clay loam that has red and light red mottles. The substratum to a depth of about 94 inches is reddish yellow clay loam that has mottles in shades of brown, yellow, red, and white.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content.

The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Wernock and Latham soils and soil that is redder throughout the profile than Allegheny soil but is otherwise similar. Also included are a few small areas of a soil that is similar to Allegheny soil but is less than 5 feet deep to bedrock. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 2 acres.

This Allegheny soil is used mainly as pasture, hay, or woodland. In a few small areas, it is used for row crops.

This soil is poorly suited to row crops because erosion is a severe hazard. Crops respond well to lime and fertilizer. If this soil is cultivated, contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and moderate yields can be obtained if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 129 cubic feet per acre. Preferred trees for planting are eastern white pine, yellow-poplar, black walnut, shortleaf pine, white ash, white oak, and northern red oak. Plant competition, the erosion hazard, and equipment use limitations are concerns in management.

This soil is suited to urban uses, but the moderately steep slope is a severe limitation. This limitation can be partly overcome by proper engineering techniques.

This Allegheny soil is in capability subclass IVe.

AnB—Allegheny loam, 2 to 6 percent slopes, rarely flooded. This soil is deep, well drained, and gently sloping. It is on low stream terraces and alluvial fans of major streams and their tributaries throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 40 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil, which extends to a depth of about 54 inches, is yellowish brown and strong brown loam in the upper part, and in the lower part, it is strong brown clay loam that has red and light red mottles. The substratum to a depth of 94 inches is reddish yellow clay loam that has mottles in shades of brown, yellow, red, and white.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. It is subject to rare flooding, and the chance of flooding is about once every 20 years. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Cotaco and Whitley soils. The included soils make up about 10 percent of this map unit, but individual areas are less than 2 acres.

This Allegheny soil is used mainly for row crops, hay, or pasture. In a few areas, it is used for homesites and gardens.

This soil is well suited to row crops and produces high yields if properly managed. Crops respond well to fertilizer and lime. Erosion is a moderate hazard, and measures to control it are needed if the soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture and produces high yields if properly managed. Management includes selection of plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 129 cubic feet per acre. Preferred trees for planting are eastern white pine, yellow-poplar, black walnut, shortleaf pine, white oak, white ash, and northern red oak. Plant competition is a concern in management.

This soil is poorly suited to most urban uses (fig. 10). Rare flooding is a severe limitation for dwellings and sanitary facilities.

This Allegheny soil is in capability subclass IIe.

AnC—Allegheny loam, 6 to 12 percent slopes, rarely flooded. This soil is deep, well drained, and sloping. It is on low stream terraces and alluvial fans of major streams and their tributaries throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 20 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil, which extends to a depth of about 54 inches, is yellowish brown and strong brown loam in the upper part, and in the lower part, it is strong brown clay loam that has red and light red mottles. The substratum to a depth of 94 inches is reddish yellow clay loam that has mottles in shades of brown, yellow, red, and white.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderate, and the available water

Figure 10.—Even infrequent flooding on soils, such as Allegheny loam, 2 to 6 percent slopes, rarely flooded, has detrimental effects on communities such as Williamsburg.

capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. It is subject to rare flooding, and the chance of flooding is about once every 20 years. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Whitley soils. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Allegheny soil is used mainly as pasture or for hay. In some small areas, it is used for row crops, and a few areas are used as homesites.

This soil is suited to cultivated crops. Crops respond well to fertilizer and lime. Erosion is a severe hazard, and measures to control it are needed if the soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture and produces high yields if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 129 cubic feet per acre. Preferred trees for planting are eastern white pine, yellow-poplar, black

walnut, shortleaf pine, white ash, white oak, and northern red oak. Plant competition is a concern in management.

This soil is poorly suited to most urban uses. Rare flooding is a severe limitation for dwellings, and slope is a moderate limitation for small buildings, roads and streets, and most sanitary facilities.

This Allegheny soil is in capability subclass IIIe.

AnD—Allegheny loam, 12 to 20 percent slopes, rarely flooded. This soil is deep, well drained, and moderately steep. It is on low stream terraces and alluvial fans of major streams and their tributaries throughout the survey area. Slopes are concave and smooth. Individual areas are 2 to 20 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil, which extends to a depth of about 54 inches, is yellowish brown and strong brown loam in the upper part, and in the lower part, it is strong brown clay loam that has red and light red mottles. The substratum to a depth of about 94 inches is reddish yellow clay loam that has mottles is shades of brown, yellow, red, and white.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. It is subject to rare flooding, and the chance of flooding is about once every 20 years. The zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Whitley soils. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Allegheny soil is used mainly as pasture, hay, or woodland. In a few small areas, it is used for row crops.

This soil is poorly suited to row crops because erosion is a severe hazard. Crops respond well to lime and fertilizer. If this soil is cultivated, conservation tillage, stripcropping, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and moderate yields can be obtained if properly managed. Management includes selecting plants that provide adequate forage and satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 129 cubic feet per acre. Preferred trees for planting are eastern white pine, yellow-poplar, black walnut, shortleaf pine, white ash, white oak, and northern red oak. Plant competition, equipment use limitations, and the erosion hazard are concerns in management.

This soil is poorly suited to most urban uses. Moderately steep slopes and rare flooding are severe limitations for dwellings and sanitary facilities.

This Allegheny soil is in capability subclass IVe.

BEF—Bledsoe-Shelocta-Rock outcrop complex, 15 to 90 percent slopes. This complex is made up of deep, well drained, and moderately steep to very steep soils and Rock outcrop. The elevation ranges from about 1,400 to 1,720 feet at the Tennessee State line and from about 1,460 to 1,800 feet at the Bell County line on the north side of Pine Mountain in Whitley County. Bledsoe and Shelocta soils are so intermingled with Rock outcrop that they can not be separated at the scale selected for mapping. Bledsoe soil is on smooth, concave side slopes and benches and lies directly below limestone outcrops. Shelocta soil is on smooth, concave side slopes, on benches, and in coves that are not directly below limestone outcrops. Limestone Rock outcrop is intermingled throughout, and some spots in this complex are bouldery. Slopes are dominantly about 55 percent. This complex consists of one delineation that extends in a continuous band the entire length of the north side of Pine Mountain.

The Bledsoe soil makes up about 43 percent of this complex. Typically, the surface layer is dark brown gravelly silt loam about 6 inches thick. The subsoil, which extends to a depth of about 58 inches, is dark brown gravelly silt loam to silty clay loam in the upper part and strong brown to brown silty clay or silty clay loam in the lower part. The substratum to a depth of about 62 inches is strong brown silty clay loam that has light brownish gray mottles.

The Bledsoe soil is high in natural fertility and moderate in organic matter content. It is slightly acid to mildly alkaline. Permeability is moderately slow, and the available water capacity is high. The root zone is deep and easily penetrated by plant roots.

The Shelocta soil makes up about 30 percent of this complex. Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, which extends to a depth of about 58 inches, is strong brown silty clay loam in the upper part, strong brown channery silty clay loam in the middle part, and yellowish brown very channery silty clay loam in the lower part. The substratum to a depth of about 74 inches is yellowish brown very channery silt loam that has mottles in shades of brown.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout. Permeability is moderate, and the available water capacity is high. The root zone is deep and easily penetrated by plant roots.

The Rock outcrop makes up about 11 percent of this complex. It is a limestone cliff tilted to the south that ranges from 5 to 75 feet in height.

Included with this complex in mapping are small areas of a colluvial soil that is deep and has a darker surface layer than the Bledsoe or Shelocta soils, and a soil formed in material weathered from limestone that is less than 40 inches deep to bedrock. Also included are small areas of stones and boulders and small areas of a colluvial soil that is deep and has a redder subsoil. The included areas make up about 16 percent of this complex, but individual areas are generally less than 10 acres.

The soils in this complex are used as woodland.

The soils are not suited to cultivated crops, hay, or pasture because of steepness of slope, Rock outcrops, and boulders.

The soils are suited to use as woodland. The Bledsoe soil has a potential productivity for yellow-poplar, at the point of highest yearly growth, of 114 cubic feet per acre. The Shelocta soil has a potential productivity for shortleaf pine of 124 cubic feet per acre. Preferred trees for planting on Bledsoe soil are yellow-poplar, white ash, white oak, and northern red oak. On Shelocta soil, they are yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, and northern red oak. The erosion hazard, equipment use limitations, and plant competition are concerns in management.

The soils in this complex are well suited to use as habitat for woodland wildlife.

The soils are poorly suited to urban uses. Steep slopes and Rock outcrop are severe limitations, and most areas are relatively inaccessible.

The Bledsoe and Shelocta soils are in capability subclass VIIe. Rock outcrop is in capability subclass VIIIs.

Bo—Bonnie silt loam, frequently flooded. This soil is deep, poorly drained to very poorly drained, and nearly level to depressional. It is on flood plains along major streams and their tributaries throughout the survey area. Slopes range from 0 to 2 percent. Individual areas are 2 to 50 acres.

Typically, the surface layer is gray silt loam about 7 inches thick. It has strong brown and reddish brown mottles. The subsoil, which extends to a depth of 18 inches, is light olive gray silt loam that has olive brown mottles. The substratum extends to a depth of 64 inches or more. In the upper part, it is gray silt loam to silty clay loam that has olive brown, yellow, and dark brown mottles. Below that, it is gray and light gray silt loam that has reddish yellow and very pale brown mottles.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderately slow, and the available water capacity is high. This soil is subject to frequent flooding of very brief duration. The chance of flooding is more than 50 percent in any one year. Flooding occurs from January to June, and crops are sometimes damaged during the growing season. This soil has a high water table at or near the surface. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Stendal, Newark, and Morehead soils and a few areas of soils similar to the Bonnie soil except they are medium acid. The included soils make up about 5 percent of this map unit, but individual areas are generally less than 2 acres.

This Bonnie soil is used mainly as pasture or for hay. Some areas are idle, or the soil is used as woodland.

Unless this soil is artificially drained, it is poorly suited to most row crops. Moderate yields can be obtained if properly drained, but crops are damaged by wetness in some years. This soil responds well to tile drainage, but some areas do not have suitable outlets. Erosion is not a hazard.

If adequately drained, this soil is suited to hay and to use as pasture. Some hay crops may be damaged by flooding. Plants that tolerate wetness should be selected. Lime and fertilizer, drainage, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, pin oak can produce a volume of 86 cubic feet per acre. Preferred trees for planting are eastern cottonwood, American sycamore, sweetgum, baldcypress, and pin oak. Equipment use limitations, seedling mortality, and plant competition are concerns in management.

This soil is well suited to use as habitat for wetland wildlife.

This soil is poorly suited to urban uses because of frequent flooding and wetness.

This Bonnie soil is in capability subclass IIIw.

ClB—Clarkrange silt loam, 2 to 6 percent slopes. This soil is deep, moderately well drained, and gently sloping. It is on upland ridgetops in the northwestern part of the survey area. Slopes are smooth and slightly convex. Individual areas are 2 to 25 acres.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 50 inches, is yellowish brown to brownish yellow silt loam in the upper part. The lower part is a firm, brittle and compact fragipan that is silty clay loam. The upper part of the fragipan is brownish yellow with yellowish brown and gray mottles. The lower part of the fragipan is mottled white and yellowish brown. The substratum is mottled white, strong brown, and reddish yellow silty clay loam. Hard brown shale bedrock is at a depth of 72 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid

throughout except where lime has been added. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is moderate. This soil has a seasonal perched water table above the fragipan at a depth of 1.5 to 2.5 feet. It has good tilth and can be worked throughout a moderate range of moisture content. The root zone and depth to fragipan range from 18 to 30 inches.

Included with this soil in mapping are small areas of Wernock soils. The included soils make up about 5 percent of this map unit, but individual areas are generally less than 2 acres.

This soil is used mainly as pasture and for hay. In some areas, it is used for row crops, and in a few small areas, it is used as woodland.

This soil is suited to row crops, and moderate yields can be obtained with good management. The fragipan restricts soil drainage and root penetration. Crops respond well to lime and fertilizer. Erosion is a moderate hazard, and measures to control it are needed if this soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture and produces moderate yields if properly managed. The fragipan restricts root penetration and limits production during dry seasons. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, northern red oak can produce a volume of 57 cubic feet per acre. Preferred trees for planting are eastern white pine, shortleaf pine, yellow-poplar, white oak, and northern red oak. Plant competition is a concern in management.

This soil is poorly suited to most urban uses because of wetness and slow or very slow permeability. Low strength is a severe limitation for local roads and streets and for use as roadfill. Some of these limitations can be overcome by proper engineering techniques.

This Clarkrange soil is in capability subclass IIe.

Co—Cotaco loam, rarely flooded. This soil is deep, somewhat poorly drained to moderately well drained, and nearly level. It is on stream terraces and alluvial fans throughout the survey area. Slopes range from 0 to 4 percent and are smooth and slightly convex. Individual areas are 2 to 50 acres.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer, which extends to a depth of 10 inches, is brown fine sandy loam. The subsoil, which extends to a depth of about 41 inches, is light yellowish brown sandy clay loam and loam. It has mottles in shades of yellow, gray, and brown. The substratum to a depth of about 70 inches is loam mottled in shades of gray, brown, yellow, and red.

This soil is medium in natural fertility and low in organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. In most areas, this soil is subject to rare flooding. The chance of flooding is about once every 20 years. The soil is saturated in winter and spring because of a seasonal high water table at a depth of 0.5 foot to 1.5 feet. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Morehead and Stokly soils. Also included are small areas of a soil that is less than 5 feet to bedrock. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This soil is used mainly as pasture and for hay, but in some areas, it is used for row crops.

This soil is suited to row crops, and moderately high yields can be obtained if the soil is drained. Crops respond well to fertilizer and lime. Erosion is not a hazard, or it is only a slight hazard. Tile drainage is commonly used to reduce wetness. Conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and high yields can be obtained if properly managed. Management includes selecting plants that tolerate wetness. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, drainage, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, Virginia pine can produce a volume of 114 cubic feet per acre. Preferred trees for planting are eastern white pine, yellow-poplar, white oak, and sweetgum. Plant competition is a concern in management.

This soil is poorly suited to most urban uses because of flooding and wetness. The seasonal high water table limits the use of this soil for septic tank absorption fields and other sanitary facilities.

This Cotaco soil is in capability subclass IIw.

Cu—Cuba silt loam, frequently flooded. This soil is deep, well drained, and nearly level. It is on flood plains throughout the survey area. Slopes range from 0 to 2 percent. Individual areas are 2 to 25 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 45 inches, is dark yellowish brown silt loam. The substratum, to a depth of about 65 inches, is yellowish brown silt loam that has mottles in shades of gray and red. To a depth of 72 inches, it is silt loam that is mottled in shades of brown and gray.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil is subject to frequent flooding of very brief duration. The chance of flooding is about twice in any one year. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Pope, Stendal, and Whitley soils. The included soils make up about 5 percent of this map unit, but individual areas are generally less than 2 acres.

This Cuba soil is used mainly for pasture, hay, or row crops.

This soil is well suited to row crops, and high yields can be obtained if properly managed. This soil is subject to frequent flooding in the winter and spring, but crops are seldom damaged during the growing season. Crops respond well to lime and fertilizer. Erosion is not a hazard.

This soil is well suited to hay and to use as pasture. Hay crops are seldom damaged by flooding. Maintenance of the desired species, control of weeds, proper stocking, rotation grazing, and lime and fertilizer are needed.

This soil is suited to use as woodland, and at the point of highest yearly growth, yellow-poplar can produce a volume of 107 cubic feet per acre. Preferred trees for planting are eastern white pine, black walnut, white oak, and yellow-poplar. Plant competition is a concern in management.

This soil is poorly suited to urban uses because of frequent flooding.

This Cuba soil is in capability subclass IIw.

FBC—Fairpoint and Bethesda soils, 0 to 20 percent slopes. This undifferentiated group of soils are deep, well drained, and nearly level to moderately steep. They are on benches, ridgetops, terraces, side slopes, and flood plains throughout the survey area. Slopes are dominantly 0 to 10 percent. Fairpoint and Bethesda soils are formed by the reshaping of spoil material from surface coal mining. They occur in an irregular pattern in the landscape, and the composition of individual delineations is variable. Slopes are generally smooth and convex. Individual areas are 5 to 200 acres.

Fairpoint soil generally makes up about 65 percent of the map unit, but this percentage is quite variable. Typically, the surface layer is brown gravelly silt loam about 12 inches thick. The substratum to a depth of about 60 inches is yellowish brown very gravelly loam in the upper part and brown very gravelly silt loam in the lower part.

This soil is low in natural fertility and organic matter content. It is medium acid to neutral. Permeability is moderately slow, and the available water capacity is low. Tilth is limited in some areas because of coarse fragments on the surface. The root zone is deep, but root penetration is limited because of coarse fragments.

Bethesda soil generally makes up about 20 percent of the map unit, but this percentage is quite variable. Typically, the surface layer is dark grayish brown channery silt loam about 12 inches thick. The substratum to a depth of about 72 inches ranges in color from yellowish brown to gray. The texture is very channery loam.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderately slow, and the available water capacity is low. Tilth is limited in some areas because of coarse fragments on the surface. The root zone is deep, but root penetration is limited because of coarse fragments.

Included with these soils in mapping are small areas of a soil that has an extremely acid surface layer, and soils that have subhorizons that range to moderately alkaline. Also included are soils that are severely eroded and gullied, and some areas of soils that have a control section that has less than 35 percent coarse fragments. Most areas include a vertical highwall that ranges from 15 to 100 feet or more in height, but dominantly are 20 to 35 feet high. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 5 acres.

Most areas in this map unit have been graded and smoothed. In some areas, the soils are barren or are reverting to native woodland, but most have been seeded to grasses or legumes, or both. In some areas, the soils are used as pasture.

The soils making up this map unit are not suited to row crops or hay. Response of plants to lime and fertilizer is variable because of the wide range of soil reaction.

This unit is suited to pasture and hay, but coarse fragments, and in places large stones, restrict the use of equipment. Differential settlement is a hazard in places. Good stands of grasses and legumes can be obtained if properly managed (fig. 11). Plant establishment is limited where the surface layer is extremely acid or at the base of highwalls where ponding or seepage causes wetness problems. The lack of moisture in dry seasons limits plant growth, and species should be selected that tolerate dry conditions and that provide a fast-growing, protective, and permanent cover. Before seeding, the spoil should be smoothed so that equipment can be

used without interference in planting and harvesting. Good quality seed should be used, and adequate fertilizer and lime need to be applied. Renovation of grasses and legumes needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, and control of undersirable vegetation are also chief management needs.

This undifferentiated group of soils is suited to use as woodland. The Fairpoint soil has a potential productivity, at the point of highest yearly growth, of 114 cubic feet per acre for loblolly pine. Bethesda soil has a potential productivity for loblolly pine of 91 cubic feet per acre. Preferred trees for planting are eastern white pine, black locust, white oak, and loblolly pine. The erosion hazard, equipment use limitations, seedling mortality, and plant competition are concerns in management.

The soils in this map unit that are graded, reseeded, and planted to herbaceous or woody plants have potential as a source of food or cover for wildlife. Any planting that provides food and enough vegetative cover to control soil erosion is beneficial to wildlife. Fertilizer, reseeding, and replanting are needed where the vegetation fails to become established.

Figure 11.—This strip mine bench in an area of Fairpoint and Bethesda soils, 0 to 20 percent slopes, has been revegetated for use as pasture. The woodland above the highwall in the background is on Latham silt loam, 12 to 20 percent slopes.

The soils of this map unit have moderate to severe limitations for urban development because of differential settlement, moderate shrink-swell potential, and moderately slow permeability. Some of these limitations can be overcome by proper engineering techniques (fig. 12).

These Fairpoint and Bethesda soils are in capability subclass VIs.

FBF—Fairpoint and Bethesda soils, 20 to 70 percent slopes. This undifferentiated group of soils are deep, well drained, and steep. They are on narrow benches and out slopes formed by the reshaping of spoil material from surface coal mining. The soils are on ridgetops and hillsides throughout the survey area. Fairpoint and Bethesda soils are in an irregular pattern on the landscape, and the composition of individual delineations is variable. Slopes are smooth to irregular and range up to several hundred feet in length. Some mapped areas include a vertical highwall and a steep bench. Individual areas are 5 to 200 acres or more and range from long bands to areas that include the entire height of the hillside.

Fairpoint soil generally makes up about 60 percent of the map unit, but this percentage is quite variable. Typically, the surface layer is brown gravelly silt loam about 12 inches thick. The substratum to a depth of about 60 inches is yellowish brown very gravelly loam in the upper part and brown very gravelly silt loam in the lower part.

This soil is low in natural fertility and organic matter content. It is medium acid to neutral. Permeability is moderately slow, and the available water capacity is low. The root zone is deep, but root penetration is limited because of coarse fragments.

Bethesda soil generally makes up about 20 percent of the map unit, but this percentage is quite variable. Typically, the surface layer is dark grayish brown channery silt loam about 12 inches thick. The substratum to a depth of about 72 inches is yellowish brown to gray very channery loam.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderately slow, and the available water capacity is low. The root zone is deep, but root penetration is limited because of coarse fragments.

Included with these soils in mapping are small areas of Latham, Shelocta, DeKalb, and Wernock soils. Also included are small areas of a soil that has subhorizons that range to moderately alkaline. Some areas are severely eroded and have deep gullies. The included

Figure 12.—This strip mine bench in an area of Fairpoint and Bethesda soils, 0 to 20 percent slopes, is being developed as homesites.

soils make up about 20 percent of this map unit, but individual areas are generally less than 5 acres.

Most areas in this map unit have been graded and smoothed. These soils have been seeded to grasses and legumes or planted to black locust or pines. Some areas are barren. In some of the older disturbed areas, the soils have been revegetated by natural processes.

The soils in this map unit are not suited to row crops. Erosion is a very severe hazard.

In most areas of these soils, grasses and legumes are difficult to establish and maintain. Steep slopes, coarse fragments, and in some places, large stones restrict the use of equipment. The steep out slopes, created by the removal of soil, parent material, and coal, commonly are unstable and are subject to slides. Differential settling is a hazard in places. Plant establishment is also limited where the surface layer is extremely acid, or at the base of highwalls where ponding or seepage causes wetness problems.

The lack of moisture during dry seasons limits plant growth and plant species. Plants that tolerate dry conditions and provide a fast-growing, protective, and permanent cover should be selected. In seeding the smoother areas, the spoil needs to be graded until smooth so that equipment can be used in planting and harvesting. Adequate amounts of seed, fertilizer, and lime need to be applied. Response of plants to lime and fertilizer is variable because of the wide range of soil reaction. In the steep areas, grasses and legumes should be seeded at the same time as the trees are seeded or planted because trees do not control erosion in the first 5 to 10 years of life. Good quality seed or planting stock is required for maximum survival and growth.

This undifferentiated group of soils is suited to use as woodland. The Fairpoint soil has a potential productivity, at the point of highest yearly growth, of 114 cubic feet per acre for loblolly pine. Bethesda soil has a potential productivity for loblolly pine of 91 cubic feet per acre. Preferred trees for planting are eastern white pine, black locust, white oak, and loblolly pine. The erosion hazard, equipment use limitation, seedling mortality, and plant competition are concerns in management.

These soils have mixed potential as a source of food or cover for wildlife. Plantings for wildlife should consist of herbaceous plants, trees, and shrubs.

These soils have severe limitations for urban uses because of steep slopes, moderately slow permeability, shrinking and swelling, and differential settlement potential. In addition, out slopes tend to be unstable, and slides can occur.

The Fairpoint and Bethesda soils are in capability subclass VIIe.

Hu—Huntington silt loam, occasionally flooded. This soil is deep, well drained, and nearly level. It is on flood plains along the Cumberland River throughout the survey area and along the Clear Fork in Whitley County. Slopes range from 0 to 2 percent. Individual areas range from 2 to 50 acres or more.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil, which extends to a depth of about 44 inches, is dark grayish brown silt loam in the upper part and dark brown silt loam in the lower part. The substratum to a depth of about 62 inches is dark brown loam.

This soil is high in natural fertility and organic matter content. It ranges from medium acid to mildly alkaline except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil is subject to occasional flooding of brief duration. The chance of flooding is about once every 2 years. Most flooding occurs from December to May and does not affect crops, such as corn and tobacco (fig. 13). This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Newark soils. Also included are a few narrow areas of soils that have slopes ranging from 2 to 30 percent. These soils are adjacent to the Cumberland River and Clear Fork. Some of the steeper soils are more sandy throughout the profile than the Huntington soil. In a few areas are soils that have a strongly acid subsoil and substratum and some small areas of soils that have a surface layer more than 24 inches thick. The included soils make up about 5 percent of this map unit, but individual areas are generally less than 2 acres.

This Huntington soil is mainly used for row crops, pasture, or hay.

This soil is well suited to row crops, and high yields can be obtained if properly managed. Crops respond well to lime and fertilizer. Erosion is not a hazard.

This soil is well suited to hay and to use as pasture. Hay crops are seldom damaged by flooding. Maintenance of the desired species, control of weeds, proper stocking, rotation grazing, and lime and fertilizer are needed.

This soil is suited to use as woodland, and at the point of highest yearly growth, yellow-poplar can produce a volume of 98 cubic feet per acre. Preferred trees for planting are yellow-poplar, northern red oak, black walnut, white oak, and eastern white pine. Plant competition is a concern in management.

This soil is poorly suited to urban uses because of occasional flooding.

This Huntington soil is in capability subclass IIw.

LaC—Latham silt loam, 6 to 12 percent slopes. This soil is moderately deep, moderately well drained, and sloping. It is on ridgetops throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 30 acres.

Figure 13.—Huntington silt loam, occasionally flooded, is well suited to crops, such as this tobacco. Flooding does occur on this soil, but it does not affect the suitability for use as cropland.

Typically, the surface layer is dark grayish brown silt loam 1 inch thick. The subsoil extends to a depth of about 24 inches. It is yellowish brown silty clay loam and strong brown silty clay in the upper part. In the lower part, it is strong brown silty clay or silty clay loam that has light gray, brown, brownish yellow, and red mottles. Soft, brown clayey shale that has gray and red coatings is at a depth of about 24 inches.

This soil is low in natural fertility and organic matter. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is slow, and the available water capacity is moderate. Runoff is rapid. This soil should be tilled during optimum moisture conditions to prevent clodding and crusting. It has a seasonal high water table at a depth of 1.5 to 3.0 feet. The shrink-swell potential is moderate. The root zone and depth to bedrock range from 20 to 40 inches.

Included with this soil in mapping are small areas of Wernock and Lily soils. Also included are small areas of a soil that has a red subsoil. Some included areas are severely eroded and have a clayey surface layer. The included soils make up about 10 percent of this map unit, but individual areas are less than 2 acres.

This Latham soil is used mainly as pasture, for hay, or as woodland. In some areas, it is used for row crops.

The soil is suited to row crops, but its use is limited because erosion is a severe hazard. Crops respond well to lime and fertilizer. If this soil is cultivated, contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and moderate yields can be obtained if properly managed. Lack of moisture limits production during dry seasons, and plants that tolerate dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected. Renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 103 cubic feet per acre. Preferred trees for planting are Virginia pine, shortleaf pine, and white oak. The erosion hazard and plant competition are concerns in management.

This soil is poorly suited to most urban uses. Slow permeability, moderate depth to rock, and slope are limitations for septic tank absorption fields. Good design and proper installation can overcome some limitations.

This Latham soil is in capability subgroup IIIe.

LaD—Latham silt loam, 12 to 20 percent slopes. This soil is moderately deep, moderately well drained, and moderately steep. It is on narrow ridgetops and upper parts of side slopes throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 35 acres.

Typically, the surface layer is dark grayish brown silt loam 1 inch thick. The subsoil extends to a depth of about 24 inches. It is yellowish brown silty clay loam and strong brown silty clay in the upper part. In the lower part, it is strong brown silty clay or silty clay loam that has light gray, brown, brownish yellow, and red mottles. Soft, brown clayey shale that has light gray and dark red coatings is at a depth of 24 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is slow, and the available water capacity is moderate. Runoff is rapid. The soil should be tilled during optimum moisture conditions to prevent clodding and crusting. It has a seasonal high water table at a depth of 1.5 to 3.0 feet. The shrink-swell potential is moderate. The root zone and depth to bedrock range from 20 to 40 inches.

Included with this soil in mapping are small areas of Wernock and Lily soils. Also included are small areas of a soil that has a red subsoil. Some included areas are severely eroded and have a clayey surface layer. The included soils make up about 15 percent of this map unit, but individual areas are less than 2 acres.

This soil is used mainly as woodland. In some areas, it is used for hay or pasture, and in a few areas, it is cultivated.

This soil is suited to occasional cultivation, but erosion is a very severe hazard. Crops respond well to lime and fertilizer. If this soil is cultivated, measures that control erosion and reduce runoff are needed. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and moderate yields can be obtained if the soil is properly managed. Lack of moisture limits production during dry seasons, and plants that tolerate dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected. Renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and at the point of highest yearly growth, shortleaf pine can produce a volume of 103 cubic feet per acre. Preferred trees for planting are Virginia pine, shortleaf pine, and white oak. The erosion hazard, equipment limitation, and plant competition are concerns in management.

This soil is poorly suited to most urban uses because of moderately steep slopes, wetness, and slow permeability. Bedrock at a depth of 20 to 40 inches hinders shallow excavation. Soils disturbed during home construction are subject to erosion, and plant cover needs to be established quickly in denuded areas. Slow permeability of the subsoil and moderate depth to bedrock are severe limitations for septic tank absorption fields.

This Latham soil is in capability subclass IVe.

LDF—Latham-DeKalb complex, 30 to 60 percent slopes. The soils in this complex are moderately deep, moderately well drained and well drained, and steep. They are on narrow ridgetops and upper side slopes throughout the survey area. Slopes are convex. Latham and DeKalb soils are so intermingled that they can not be separated at the scale selected for mapping. Individual areas are 10 to several hundred acres and range from narrow ridgetops to the entire upper slopes.

The Latham soil makes up about 60 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam 1 inch thick. The subsoil extends to a depth of about 24 inches. It is yellowish brown silty clay loam and strong brown silty clay in the upper part. In the lower part, it is strong brown silty clay or silty clay loam that has light gray, brownish yellow, and red mottles. Soft, brown clayey shale that has gray or red coatings is at a depth of 24 inches.

The Latham soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is slow, and the available water capacity is moderate. The root zone is moderately deep and easily penetrated by plant roots. This soil has a seasonal high water table at a depth of 1.5 to 3.0 feet. The shrink-swell potential is moderate. Depth to soft bedrock ranges from 20 to 40 inches.

DeKalb soil makes up about 25 percent of the map unit. Typically, the surface layer is very dark gray and light yellowish brown fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of about 20 inches, is brownish yellow channery or very channery fine sandy loam. The substratum, to a depth of 31 inches, is brownish yellow very channery fine sandy loam. Sandstone bedrock is at a depth of 31 inches.

The DeKalb soil is low in natural fertility and organic matter content. It is extremely acid to strongly acid throughout except where lime has been added. Permeability is rapid, and the available water capacity is low. The root zone is moderately deep and easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Included with this complex in mapping are small areas of Steinsburg, Lily, and Wernock soils. Some areas are stony. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 10 acres.

The soils of this complex are used mainly as woodland, but in a few small areas on smoother slopes, the soils are used as pasture.

These soils are not suited to row crops because of the steep slopes and hazard of erosion.

These soils are poorly suited to hay and to use as pasture. Most slopes are too steep for the use of modern machinery to establish and maintain adequate pasture cover. In areas that are in pasture, lack of moisture limits production during dry seasons; therefore, plants that tolerate dry conditions, produce adequate forage, provide satisfactory ground cover, and require the least amount of renovation should be selected. Overgrazing reduces the stand of desirable grasses and legumes and results in excessive erosion.

This complex is suited to use as woodland. The Latham soil on north slopes has a potential productivity, at the point of highest yearly growth, of 122 cubic feet per acre for shortleaf pine. The potential productivity is 103 cubic feet per acre per year for shortleaf pine on the south slopes. The DeKalb soils on north slopes has a potential productivity of 97 cubic feet per acre for yellow-poplar. On south slopes, it is 103 cubic feet per acre for shortleaf pine. Preferred trees for planting on north slopes of Latham soil are shortleaf pine, eastern white pine, and white oak. On south slopes, they are northern red oak, Virginia pine, eastern white pine, white ash, and white oak. Preferred trees for planting on north slopes of DeKalb soils are eastern white pine, shortleaf pine, white oak, and yellow-poplar. On south slopes, they are eastern white pine and Virginia pine. The erosion hazard, equipment use limitations, seedling mortality, and plant competition are concerns in management on north and south slopes of the Latham soil. The erosion hazard, equipment use limitations, and plant competition are concerns on north slopes of the DeKalb soil. Equipment use limitations, seedling mortality, and the erosion hazard are concerns on south slopes of DeKalb soil.

This complex is suited to use as habitat for woodland wildlife.

This complex is poorly suited to urban uses because of very steep slopes and the moderate depth to bedrock.

These Latham and DeKalb soils are in capability subclass VIIe.

LIC—Lily loam, 6 to 12 percent slopes. This soil is moderately deep, well drained, and sloping. It is on ridgetops. Individual areas are 2 to 20 acres.

Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil, which extends to a depth of about 26 inches, is brownish yellow sandy clay loam in the upper part and yellowish brown clay loam in the lower part. Sandstone bedrock is at a depth of 26 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderately rapid, and the available water capacity is moderate. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is moderately deep and easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

Included with this soil in mapping are small areas of Wernock and Latham soils. Also included are small areas of Lily soil that has slopes of less than 6 percent. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 2 acres.

This Lily soil is used mainly as pasture, for hay or as woodland. In some areas, it is used for row crops.

This soil is suited to row crops, but it's use is limited because erosion is a severe hazard. Crops respond well to fertilizer and lime. Measures to control erosion are needed if this soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and moderate yields can be obtained if properly managed. The moderately deep root zone and lack of moisture in dry seasons limits production. Management includes selecting plants that tolerate dry conditions, provide adequate forage, and give satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper

stocking, rotation grazing, and control of undesirable species are also chief management needs.

This soil is suited to use as woodland and the potential productivity for shortleaf pine is 95 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are shortleaf pine, Virginia pine, white oak, eastern white pine, yellow-poplar and northern red oak. Plant competition is a concern in management.

This soil is suited to urban uses, but depth to bedrock is a severe limitation for dwellings with basements, septic tank absorption fields, and most other sanitary facilities. Some of these limitations can be overcome by proper engineering techniques.

This Lily soil is in capability subclass IIIe.

LSD—Lily-Steinsburg fine sandy loams, 12 to 30 percent slopes. The soils of this complex are moderately deep, well drained, and moderately steep and steep. They are on long, convex ridgetops and upper side slopes on the south side of Pine Mountain. Lily and Steinsburg soils are so intermingled that they can not be separated at the scale selected for mapping. Individual areas are 60 to several hundred acres.

The Lily soil makes up about 55 percent of the map unit. Typically, the surface layer is dark brown fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of about 26 inches, is brownish yellow sandy clay loam in the upper part and yellowish brown clay loam in the lower part. Sandstone bedrock is at a depth of 26 inches.

The Lily soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderately rapid, and the available water capacity is moderate. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is moderately deep and easily penetrated by plant roots. Depth to bedrock ranges from 20 to 40 inches.

The Steinsburg soil makes up about 30 percent of the map unit. Typically, the surface layer is yellowish brown fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of about 20 inches, is yellowish brown fine sandy loam. The substratum to a depth of 29 inches is yellowish brown gravelly fine sandy loam. Soft sandstone bedrock is at a depth of 29 inches.

The Steinsburg soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid. Permeability is moderately rapid, and available water capacity is low. The root zone is moderately deep and easily penetrated by plant roots. Depth to soft sandstone bedrock ranges from 24 to 40 inches.

Included with this complex in mapping are small areas of Wernock and DeKalb soils. Also included are soils that are less than 20 inches deep to bedrock and some areas of soils that have slopes of more than 30 percent. Some areas are stony and others have rock outcrops (fig. 14). The included soils and rock outcrops make up about 15 percent of this map unit, but individual areas are generally less than 5 acres.

The soils of this complex are used mainly as woodland. Most areas are inaccessible.

These soils are not suited to row crops. The steep slopes limit the use of modern machinery, and erosion is a very severe hazard.

These soils are poorly suited to hay and to use as pasture. Most areas are inaccessible to modern machinery, and some areas have stones on the surface or have rock outcrops. On some of the smoother slopes, moderate yields can be obtained if properly managed. The moderately deep root zone and lack of moisture in dry seasons limit production, and plants that tolerate dry conditions, produce adequate forage, and give satisfactory ground cover should be selected. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable species are also chief management needs.

The soils of this complex are suited to use as woodland. The potential productivity is 95 cubic feet per acre, at the point of highest yearly growth, for shortleaf pine on Lily soil. Virginia pine on Steinsburg soil has potential productivity of 104 cubic feet per acre. The preferred trees for planting are eastern white pine, shortleaf pine, and white oak. Yellow-poplar, Virginia pine, and northern red oak are the preferred trees to plant on the Lily soils. The erosion hazard, equipment use limitations, and plant competition are concerns in management. Seedling mortality is also a concern on Steinsburg soil.

These soils are well suited to use as habitat for woodland wildlife.

These soils are poorly suited to most urban uses. Moderate depth to bedrock is a severe limitation for dwellings with basements, septic tank absorption fields, and other sanitary facilities. The moderately steep to steep slopes are a severe limitation that is difficult to overcome.

The Lily and Steinsburg soils are in capability subclass VIe.

Mo—Morehead silt loam, rarely flooded. This soil is deep, somewhat poorly drained to moderately well drained and nearly level. It is on stream terraces and alluvial fans throughout the survey area. Slopes range from 0 to 4 percent and are smooth to slightly concave. Individual areas are 2 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil, which extends to a depth of about 49 inches, is silt loam. It is yellowish brown in the upper part, light yellowish brown in the middle part, and mottled strong brown, light yellowish brown, and light brownish gray in the lower part. The

Figure 14.—This natural arch of conglomerate sandstone is in a scenic area on the south side of Pine Mountain. The outcrop is in an area of Lily-Steinsburg fine sandy loams, 12 to 30 percent slopes.

substratum to a depth of about 67 inches is mottled light gray and light yellowish brown loam.

This soil is medium in natural fertility and low in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth. It is saturated in the winter and spring because of a seasonal high water table at a depth of 0.5 foot to 1.5 feet. Most areas of this soil are subject to rare flooding. The chance of flooding is about once every 20 years. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Cotaco and Stendal soils. Also included are small areas of a soil that is less than 5 feet to bedrock. Some included soils have more clay in the subsoil than is characteristic for Morehead soils. The included soils make up about 10 percent of this map unit, but individual areas generally are less than 2 acres.

This Morehead soil is used mainly as pasture or for hay. In some areas, it is used for row crops.

This soil is suited to row crops, if drained, and moderately high yields can be obtained if properly managed. Crops respond well to fertilizer and lime. Erosion is a slight hazard. Tile drainage is commonly used to reduce the wetness limitation of this soil. Conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help maintain organic matter.

This soil is suited to hay and to use as pasture, and high yields can be obtained if properly managed. Management includes selecting plants that tolerate wetness. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, drainage, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and potential productivity for shortleaf pine is 138 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are shortleaf pine, yellow-poplar, sweetgum, pin oak, and eastern white pine. Plant competition and equipment use limitations are concerns in management.

This soil is poorly suited to most urban uses because of wetness and rare flooding. The seasonal high water table limits the use for septic tank absorption fields.

This Morehead soil is in capability subclass IIw.

Ne—Newark silt loam, occasionally flooded. This soil is deep, somewhat poorly drained, and nearly level. It is on flood plains along the Cumberland River throughout the survey area and along the Clear Fork in Whitley County. Slopes range from 0 to 2 percent. Individual areas are 2 to 30 acres.

Typically, the surface layer is brown silt loam about 9 inches thick. It has gray and yellowish brown mottles. The subsoil extends to a depth of about 40 inches. In the upper part, it is brown silt loam that has grayish brown and strong brown mottles, and in the lower part, it is light brownish gray silt loam that has yellowish brown mottles. The substratum to a depth of about 85 inches is grayish brown silt loam in the upper part and gray silt loam in the lower part. It has mottles in shades of brown, red, and yellow throughout.

This soil is high in natural fertility and moderate in organic matter content. It is medium acid to mildly alkaline. Permeability is moderate, and the available water capacity is high. This soil is saturated in winter and spring because of a seasonal high water table at a depth of 0.5 foot to 1.5 feet. It is subject to occasional flooding of brief duration. The chance of flooding is about once every 2 years or less. Most floods occur in winter or early in spring and do not affect crops, such as corn. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Huntington and Bonnie soils. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Newark soil is used mainly as pasture or for hay. In some areas, it is used for row crops.

This soil is suited to row crops, if drained, and high yields can be obtained with good management. Flooding and wetness can limit crop production. Tile drainage is commonly used to correct the wetness limitation. Crops respond well to fertilizer. Erosion is not a hazard.

This soil is suited to hay and to use as pasture. Plants that tolerate wetness should be selected. Pasture renovation needs to be frequent enough to maintain the desired species. Fertilizer, drainage, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and the potential productivity for pin oak is 93 cubic feet per acre, at the point of highest yearly growth. Preferred trees for planting are eastern cottonwood, sweetgum, and American sycamore. Plant competition, equipment use limitations, and seedling mortality are concerns in management.

This soil is poorly suited to urban uses because of wetness and occasional flooding.

This Newark soil is in capability subclass IIw.

Pd—Pits-Dumps complex. This complex consists of waste material from a coal washing and preparation plant.

This material consists of black shale fragments, coal dust, and impurities separated from the coal during processing and stacked in alternating layers of coarse and fine material. Dumps consists of the coarse material hauled into place. The fine material is pumped into pits or ponds as slurry. Pits and Dumps are so intermingled that they can not be separated at the scale selected for mapping. Slopes range from 0 to 15 percent.

This waste material is extremely acid and generally devoid of vegetation.

This complex is in capability subclass VIIIs.

Pg—Pope gravelly fine sandy loam, frequently flooded. This soil is deep, well drained, and nearly level. It is on flood plains in narrow valleys mainly in the northeastern part of Knox County (fig. 15). Slopes range from 0 to 2 percent. Individual areas are 2 to 25 acres.

Typically, the surface layer is brown gravelly fine sandy loam about 8 inches thick. The subsoil, which extends to a depth of about 32 inches, is brown gravelly fine sandy loam in the upper part and dark yellowish brown gravelly fine sandy loam in the lower part. The substratum to a depth of about 60 inches is dark yellowish brown very channery loamy sand.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderately rapid, and the available water capacity is moderate. This soil can be worked throughout a wide range of moisture content. It is subject to frequent flooding of very brief or brief duration. The chance of flooding is about twice in any one year. Most floods occur in winter or early in spring, and crops, such as corn, are seldom damaged by flooding during the growing season. The root zone is deep and easily penetrated by plant roots.

Figure 15.—Pope gravelly fine sandy loam, frequently flooded, is in narrow valleys. This soil is suited to use as cropland, woodland, pasture, and for hay.

Included with this soil in mapping are small areas of Stokly and Shelocta soils. A few areas of soils that are less acidic than the Pope soil are also included. The included soils make up 5 to 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Pope soil is used mainly as pasture or for hay. In some areas, it is used for row crops and gardens.

This soil is suited to row crops, and high yields can be obtained if properly managed. Potential productivity is reduced during dry years by lack of moisture. Crops respond well to fertilizer and lime. Erosion is a slight hazard, but in a few areas near stream channels, this soil is subject to scouring during overflow.

This soil is well suited to hay and to use as pasture. Hay crops are seldom damaged by flooding. Maintenance of the desired species, control of weeds, proper stocking, rotation grazing, and lime and fertilizer are needed.

This soil is suited to use as woodland, and potential productivity for yellow-poplar is 100 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are eastern white pine, yellow-poplar, black walnut, white oak, northern red oak, white ash, and shortleaf pine. Plant competition is a concern in management.

This soil is poorly suited to urban uses because of frequent flooding.

This Pope soil is in capability subclass IIw.

RSF—Rigley-Shelocta-Rock outcrop complex, 30 to 60 percent slopes. The soils of this complex are deep, well drained, and steep and very steep. These soils and the Rock outcrop in this complex are on side slopes in deep ravines on the south side of Pine Mountain in Whitley County. Rigley and Shelocta soils are so intermingled with Rock outcrops that they can not be separated at the scale selected for mapping. Rigley soils are on side slopes and lie directly below sandstone Rock outcrops. Shelocta soils are on side slopes that do not have Rock outcrops directly above them. Rock fragments in the surface layer range from none to about 30 percent within a short distance. The fragments are pebble, cobble, or boulder size. Individual areas are 10 to several hundred acres and commonly include the entire height of the ravine.

The Rigley soil makes up about 50 percent of the map unit. Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsoil, which extends to a depth of about 45 inches, is brown and dark yellowish brown loam in the upper part and brown and yellowish brown channery loam in the lower part. The substratum to a depth of about 62 inches is yellowish brown very channery sandy clay loam that has pale brown mottles.

The Rigley soil is medium in natural fertility and low in organic matter content. It is strongly acid to extremely acid. Permeability is moderately rapid, and the available water capacity is moderate to high. The root zone is deep and easily penetrated by plant roots.

The Shelocta soil makes up about 30 percent of the map unit. Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, which extends to a depth of about 58 inches, is strong brown silty clay loam in the upper part, strong brown channery silty clay loam in the middle part, and yellowish brown very channery silty clay loam in the lower part. The substratum to a depth of about 74 inches is yellowish brown very channery silt loam that has mottles in shades of brown.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout. Permeability is moderate, and the available water capacity is high. The root zone is deep and easily penetrated by plant roots.

Rock outcrop makes up about 15 percent of the map unit (fig. 16). Typically, it is a sandstone cliff tilted to the south ranging from 10 to 90 feet in height near the top of ravines. In many areas, large boulders and stones have broken from the Rock outcrop and are scattered throughout the lower part of the ravine.

Included with this complex in mapping are small areas of Lily and Steinsburg soils on convex points. The included soils make up about 5 percent of this map unit, but individual areas are generally less than 10 acres.

The soils of this complex are used mainly as woodland.

These soils are not suited to cultivated crops, pasture, or hay because of steepness of slope, Rock outcrops, and boulders.

These soils are suited to use as woodland. The Rigley soil on north slopes has a potential productivity, at the point of highest yearly growth, of 129 cubic feet per acre for shortleaf pine. On south slopes, the potential productivity is 47 cubic feet per acre for white oak. The Shelocta soil has a potential productivity for shortleaf pine of 124 cubic feet per acre on north slopes. On south slopes, the potential productivity is 52 cubic feet per acre for black oak. Preferred trees for planting on north slopes are yellow-poplar, eastern white pine, shortleaf pine, white oak, and northern red oak. Eastern white pine, shortleaf pine, and white oak are preferred trees to plant on south slopes. The erosion hazard, equipment use limitations, and plant competition are concerns in management. Seedling mortality is also a concern on south slopes.

These soils are suited to use as habitat for woodland wildlife.

These soils are poorly suited to most urban uses. Very steep slopes and Rock outcrop limit the use for urban development. Most areas are inaccessible.

The Rigley and Shelocta soils are in capability subgroup VIIe. Rock outcrop is in capability subclass VIIIs.

ShB—Shelocta gravelly silt loam, 2 to 6 percent slopes. This soil is deep, well drained, and gently sloping. It is on alluvial fans and colluvial foot slopes throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 30 acres.

Typically, the surface layer is dark brown gravelly silt loam about 9 inches thick. The subsoil, which extends to a depth of about 42 inches, is yellowish brown silty clay loam and gravelly silty clay loam. The substratum to a depth of about 60 inches is yellowish brown very gravelly silty clay loam or silt loam.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Stendal, Cotaco, Whitley, Morehead, Stokly, and Pope soils. Also included is a small acreage of a soil that has a darker surface layer than Shelocta soil but is otherwise similar. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Shelocta soil is used mainly for row crops, hay, or pasture. In many small areas, it is used for homesites or gardens.

Figure 16.—This Sandstone Rock outcrop is in an area of Rigley-Shelocta-Rock outcrop complex, 30 to 60 percent slopes.

This soil is well suited to most row crops. Crops respond well to fertilizer and lime. Erosion is a moderate hazard, and measures to control it are needed if this soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture, and high yields can be obtained if properly managed. Management includes selecting plants that provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species.

Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and the potential productivity is 124 cubic feet per acre for shortleaf pine at the point of highest yearly growth. The preferred trees for planting are yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, and northern red oak. Plant competition is a concern in management.

This soil is well suited to most urban uses.

This Shelocta soil is in capability subclass IIe.

ShC—Shelocta gravelly silt loam, 6 to 12 percent slopes. This soil is deep, well drained, and sloping. It is on small alluvial fans and colluvial foot slopes throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 30 acres.

Typically, the surface layer is dark brown gravelly silt loam about 9 inches thick. The subsoil, which extends to a depth of about 42 inches, is yellowish brown silty clay loam and gravelly silty clay loam. The substratum to a depth of about 60 inches is yellowish brown very gravelly silty clay loam or silt loam.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Allegheny and Wernock soils. Also included are small areas of Shelocta soil that have less than 5 percent gravel in the surface layer. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Shelocta soil is used mainly as pasture or for hay. In some small areas, it is used for row crops. This soil is suited to row crops, but its use is limited because erosion is a severe hazard. Crops respond well to fertilizer and lime. If this soil is cultivated, contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and high yields can be obtained if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also management needs.

This soil is suited to use as woodland, and the production potential is 124 cubic feet per acre for shortleaf pine, at the point of highest yearly growth. The preferred trees for planting are yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, and northern red oak. Plant competition is a concern in management.

This soil is suited to most urban uses. Slope is a limitation for some uses, but this limitation can be overcome by proper engineering techniques.

This Shelocta soil is in capability subclass IIIe.

ShD—Shelocta gravelly silt loam, 12 to 20 percent slopes. This soil is deep, well drained, and moderately steep. It is on colluvial foot slopes and lower parts of hillsides throughout the survey area. Slopes are smooth and slightly concave. Individual areas are 2 to 35 acres.

Typically, the surface layer is dark brown gravelly silt loam about 9 inches thick. The subsoil, which extends to a depth of about 42 inches, is yellowish brown silty clay loam and gravelly silty clay loam. The substratum to a depth of about 60 inches is yellowish brown very gravelly silty clay loam or silt loam.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Allegheny and Wernock soils. Also included are small areas of Shelocta soil that have less than 5 percent gravel in the surface layer. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Shelocta soil is used mainly as pasture or for hay. In a few small areas, it is used for row crops (fig. 17).

This soil is poorly suited to row crops because erosion is a severe hazard. Crops respond well to lime and fertilizer. If this soil is cultivated, contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture, and moderate yields can be obtained if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland. On north slopes, it has a potential productivity of 124 cubic feet per acre for shortleaf pine at the point of highest yearly growth. On south slopes, the potential productivity is 52 cubic feet per acre for black oak. The preferred trees for

Figure 17.—Pasture and hay are the major uses of Shelocta gravelly silt loam, 12 to 20 percent slopes. The woodland in the background is in an area of Shelocta-Latham silt loams, 30 to 60 percent slopes.

planting on north slopes is yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, and northern red oak. On south slopes, they are shortleaf pine, white oak, and eastern white pine. Plant competition, the erosion hazard, and equipment use limitations are concerns in management on both slopes, and seedling mortality is also a concern on south slopes.

This soil is poorly suited to most urban uses because of moderately steep slopes. This limitation can be reduced by proper engineering techniques.

This Shelocta soil is in capability subclass IVe.

SLE—Shelocta-Latham silt loams, 20 to 30 percent slopes. These soils are deep and moderately deep, well drained and moderately well drained, and steep. They are on side slopes throughout the survey area. Shelocta and Latham soils are so intermingled that they can not be separated at the scale selected for mapping. Shelocta soil is on smooth, concave side slopes and in coves, and the Latham soil is on the upper parts of convex side slopes. Individual areas are 10 to several hundred acres and range from narrow bands to areas that include the entire height of the side slope.

The Shelocta soil is deep. It makes up about 50 percent of the map unit. Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, which extends to a depth of about 58 inches, is strong brown silty clay loam in the upper part, strong brown channery silty clay loam in the middle part, and yellowish brown very channery silty clay loam in the lower part. The substratum to a depth of 74 inches is yellowish brown very channery silt loam that has mottles in shades of brown.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. The root zone is deep and easily penetrated by plant roots.

The Latham soil is moderately deep. It makes up about 35 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam about 1 inch thick. The subsoil is about 23 inches thick. It is strong brown silty clay loam in the upper part, and in the lower part, it is strong brown silty clay or silty clay loam that has light

gray, brownish yellow, and red mottles. The substratum, which extends to a depth of about 35 inches, is brown clayey shale that has gray and red coatings.

The Latham soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is slow, and the available water capacity is moderate. The root zone is moderately deep and easily penetrated by plant roots. This soil has a seasonal high water table at a depth of 1.5 to 3.0 feet. The shrink-swell potential is moderate. Depth to soft bedrock ranges from 20 to 40 inches.

Included with these soils in mapping are small areas of Lily, DeKalb, Steinsburg, and Wernock soils on ridgetops and upper parts of hillsides. Also included are areas of a deep colluvial soil that has more sand than is characteristic for Shelocta soil. Some areas of soils that are severely eroded and have a heavier surface layer texture are also included. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 5 acres.

These Shelocta and Latham soils are used mainly as woodland, but in many areas, they are used as pasture.

These soils are poorly suited to row crops because steep slopes limit the use of modern machinery and erosion is a very severe hazard.

These soils are suited to use as pasture, and moderate yields can be obtained if properly managed. Management includes selecting grasses and legumes that produce good plant cover and require the least amount of renovation. Overgrazing reduces the stand of desirable grasses and legumes, resulting in excessive soil erosion.

These soils are suited to use as woodland. Shelocta soil on north slopes has a potential productivity, at the point of highest yearly growth, of 124 cubic feet per acre for shortleaf pine. On south slopes, the potential productivity is 52 cubic feet per acre for black oak. Latham soil has a potential productivity for shortleaf pine of 122 cubic feet per acre on north slopes and 103 cubic feet per acre on south slopes. Preferred trees for planting on north slopes of Shelocta soil are yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, and northern red oak. Shortleaf pine, white oak, and eastern white pine are preferred trees to plant on south slopes of Shelocta and north slopes of Latham. Virginia pine, white oak, and shortleaf pine are preferred trees to plant for Latham soil on south slopes. Plant competition, the erosion hazard, and equipment limitations are concerns in management. Seedling mortality is also a concern on south slopes of Shelocta soil and both slopes of Latham soil.

These soils are suited to use as habitat for woodland wildlife.

These soils are poorly suited to urban uses because of steep slopes.

These Shelocta and Latham soils are in capability subclass VIe.

SLF—Shelocta-Latham silt loams, 30 to 60 percent slopes. These soils are deep and moderately deep, well drained and moderately well drained, and very steep. They are on side slopes throughout the survey area. Shelocta and Latham soils are so intermingled that they can not be separated at the scale selected for mapping. The Shelocta soil is on smooth, concave side slopes and in coves, and the Latham soil is on the upper parts of convex, steep side slopes and narrow ridgetops. Individual areas are 10 to several hundred acres and commonly include the entire height of the side slope.

The Shelocta soil is deep. It makes up about 60 percent of the unit. Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, which extends to a depth of about 58 inches, is strong brown silty clay loam in the upper part, strong brown channery silty clay loam in the middle part, and yellowish brown very channery silty clay loam in the lower part. The substratum to a depth of 74 inches is yellowish brown very channery silt loam that has mottles in shades of brown.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. The root zone is deep and easily penetrated by plant roots.

The Latham soil is moderately deep. It makes up about 25 percent of the map unit. Typically, the surface layer is dark grayish brown silt loam about 1 inch thick. The subsoil extends to a depth of about 24 inches. It is strong brown silty clay loam in the upper part, and in the lower part, it is strong brown silty clay or silty clay loam that has light gray, brown, brownish yellow, and red mottles. Soft, brown clayey shale that has gray and red coatings is at a depth of about 24 inches.

The Latham soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is slow, and the available water capacity is moderate. The root zone is moderately deep and easily penetrated by plant roots. A seasonal high water table is at a depth of 1.5 to 3.0 feet. The shrink-swell potential is moderate. Depth to soft bedrock ranges from 20 to 40 inches.

Included with these soils in mapping are small areas of Lily, Steinsburg, DeKalb, and Wernock soils on convex slopes and ridgetops. Also included are areas of a deep, colluvial soil that has more sand than is characteristic for Shelocta soil and small areas of a soil that is similar to Shelocta soil but has a darker surface layer. Some soils that are severely eroded and have a silty clay loam surface layer are also included as well as some areas that are stony. The included soils make up about 15

percent of this map unit, but individual areas are generally less than 10 acres.

The Shelocta and Latham soils are used mainly as woodland. In some areas, they are used as pasture.

These soils are not suited to row crops. The very steep slopes limit the use of modern machinery, and erosion is a very severe hazard.

These soils are poorly suited to hay and to use as pasture. Most slopes are too steep to use machinery for establishing and maintaining adequate pasture cover. Overgrazing reduces the stand of desirable grasses and legumes and causes excessive soil erosion. Grasses and legumes that produce good plant cover are preferred if renovation is needed.

These soils are suited to use as woodland. The Shelocta soil on north slopes has a potential productivity, at the point of highest yearly growth, of 124 cubic feet per acre for shortleaf pine. On south slopes, the potential productivity is 52 cubic feet per acre for black oak. Latham soil has a potential productivity for shortleaf pine of 122 cubic feet per acre on north slopes and 103 cubic feet per acre on south slopes. Preferred trees for planting on north slopes of Shelocta soil are yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, and northern red oak. Shortleaf pine, white oak, and eastern white pine are preferred trees for planting on south slopes. Virginia pine, northern red oak, eastern white pine, white oak, and white ash are preferred trees to plant on Latham soil on north and south slopes. The erosion hazard, equipment use limitations, and plant competition are concerns in management. Seedling mortality is a concern on the Latham soil and on south slopes of the Shelocta soil.

These soils are suited to use as habitat for woodland wildlife. They are poorly suited to urban uses because of the very steep slopes.

This complex is in capability subclass VIIe.

SSF—Steinsburg-Shelocta-Rock outcrop complex, 35 to 80 percent slopes. This complex is made up of Rock outcrop and soils that are moderately deep and deep, well drained, and steep and very steep. These soils and Rock outcrop are on upper side slopes. Elevations range from about 1,720 to 1,920 feet at the Tennessee line and from about 1,800 to 2,060 feet at the Bell County line on the north side of Pine Mountain in Whitley County. Steinsburg and Shelocta soils are so intermingled with Rock outcrop that they can not be separated at the scale selected for mapping. Steinsburg soil is on convex slopes and ranges from the mountaintop down to the Rock outcrop. Shelocta soil is on smooth, concave side slopes and in coves. Sandstone Rock outcrops are intermingled throughout the complex. This complex consists of one delineation that extends in a continuous narrow band the entire length of the south side of Pine Mountain.

The Steinsburg soil is moderately deep. It makes up about 45 percent of this complex. Typically, the surface layer is yellowish brown fine sandy loam about 6 inches thick. The subsoil, which extends to a depth of about 20 inches, is yellowish brown fine sandy loam. The substratum, which extends to a depth of 29 inches, is yellowish brown gravelly fine sandy loam. Soft sandstone is at a depth of 29 inches.

The Steinsburg soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid. Permeability is moderately rapid, and the available water capacity is low. The root zone is moderately deep and easily penetrated by plant roots. Depth to soft sandstone bedrock ranges from 24 to 40 inches.

The Shelocta soil is deep. It makes up about 30 percent of this complex. Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil, which extends to a depth of about 58 inches, is strong brown silty clay loam in the upper part, strong brown channery silty clay loam in the middle part, and yellowish brown very channery silty clay loam in the lower part. The substratum to a depth of 74 inches is yellowish brown very channery silt loam that has mottles in shades of brown.

The Shelocta soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout. Permeability is moderate, and the available water capacity is high. The root zone is deep and easily penetrated by plant roots.

Rock outcrop makes up about 12 percent of this complex. Typically, it is a sandstone cliff, tilted to the south, ranging from 5 to 100 feet in height. In many places, large boulders and stones have broken from the Rock outcrop and are scattered throughout the area. The stones and boulders range from 1 to 10 feet across, but some are 35 feet or more.

Included with this complex in mapping are small areas of Lily soil and Rubble land. Also included are small areas of a deep, colluvial soil that has a fine sandy loam or loam surface layer. The included soils make up about 13 percent of this map unit, but individual areas are generally less than 10 acres.

The soils of this complex are used as woodland.

These soils are not suited to cultivated crops, hay, or pasture because of steepness of slope and Rock outcrops.

These soils are suited to use as woodland. Steinsburg soil has a potential productivity of 104 cubic feet per acre at the point of highest yearly growth for Virginia pine. Shelocta soil has a potential productivity of 52 cubic feet per acre for black oak. Preferred trees for planting are eastern white pine, white oak, and shortleaf pine. The erosion hazard, equipment use limitations, seeding mortality, and plant competition are concerns in management.

These soils are suited to use as habitat for woodland wildlife.

The soils of this complex are poorly suited to urban uses because of the very steep slopes and Rock outcrops. Most areas of these soils are relatively inaccessible.

The Steinsburg and Shelocta soils are in capability subclass VIIe. Rock outcrop is in capability subclass VIIIs.

St—Stendal silt loam, frequently flooded. This soil is deep, somewhat poorly drained, and nearly level. It is on flood plains throughout the survey area. Slopes range from 0 to 2 percent. Individual areas range form 2 to several hundred acres.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 16 inches, is brown silt loam that has dark yellowish brown mottles. The substratum extends to a depth of about 60 inches. In the upper part, it is grayish brown silt loam that has olive brown mottles, and in the lower part, it is gray silty clay loam that has yellowish brown and light olive brown mottles.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth. It is saturated during the winter and spring because of a seasonal high water table at a depth of 1 foot to 2 feet. This soil is subject to frequent flooding of very brief duration. The chance of flooding is about twice in any one year. Most floods are in winter and early in spring, and crops such as corn are seldom damaged by flooding during the growing season. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bonnie, Cuba, Stokly, and Morehead soils. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Stendal soil is used mainly for pasture, hay, or row crops (fig. 18). Some areas are idle, or the soil is used as woodland.

This soil is suited to row crops, if drained, and moderately high yields can be obtained with good management. Flooding and wetness may limit crop production. Tile drainage is commonly used to reduce wetness. Crops respond well to lime and fertilizer. Erosion is not a hazard.

This soil is suited to hay and to use as pasture. Crops are seldom damaged by flooding, but plants that tolerate wetness should be selected. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, drainage, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland, and potential productivity for pin oak is 86 cubic feet per acre at the point of highest yearly growth. The preferred trees for planting are eastern white pine, baldcypress, American sycamore, green ash, and sweetgum. Plant competition, seedling mortality, and equipment use limitations are concerns in management.

This soil is poorly suited to urban use because of flooding and wetness.

This Stendal soil is in capability subclass IIw.

Sv—Stokly fine sandy loam, frequently flooded. This soil is deep, somewhat poorly drained, and nearly level. It is on flood plains of small streams in eastern Knox County. Slopes range from 0 to 2 percent. Individual areas are 2 to 30 acres.

Typically, the surface layer is dark yellowish brown fine sandy loam about 8 inches thick. The subsoil, which extends to a depth of about 35 inches, is pale brown fine sandy loam in the upper part and light brownish gray fine sandy loam in the lower part. The substratum to a depth of about 60 inches is mottled strong brown and gray loamy sand.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability is moderately rapid, and the available water capacity is moderate. This soil has good tilth. It is saturated during the winter and spring because of a seasonal high water table at a depth of 0.5 to 1.0 foot. This soil is subject to frequent flooding of very brief duration. The chance of flooding is about twice in any one year. Most flooding occurs in winter or early in spring, and crops such as corn are seldom damaged by flooding during the growing season. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Pope, Bonnie, Stendal, and Cotaco soils. The included soils make up about 5 percent of this map unit, but individual areas are generally less than 2 acres.

This Stokly soil is used mainly for pasture, hay, or row crops. Some small areas are idle or in woodland.

This soil is suited to row crops, if drained, and moderately high yields can be obtained with good management. Tile drainage is commonly used to reduce wetness. Crops respond well to lime and fertilizer. Erosion is not a hazard.

This soil is suited to hay and to use as pasture. Some hay crops are damaged by flooding. Plants that tolerate wetness should be selected, and pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, drainage, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland. The potential productivity for yellow-poplar is 90 cubic feet per acre at the point of highest yearly growth. The preferred trees for planting are eastern white pine, American sycamore, sweetgum, and yellow-poplar. Plant competition, seedling

Figure 18.—This area of Stendal silt loam, frequently flooded, is used as pasture. The woodland is on Shelocta-Latham silt loams, 30 to 60 percent slopes.

mortality, and equipment use limitations are concerns in management.

This soil is poorly suited to urban uses because of flooding and wetness.

This Stokly soil is in capability subclass IIw.

WnB—Wernock silt loam, 2 to 6 percent slopes. This soil is moderately deep, well drained, and gently sloping. It is on ridgetops mainly in the northwest part of Knox County, but small areas occur throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 75 acres.

Typically, the surface layer is very dark grayish brown silt loam about 2 inches thick. The subsurface layer, which extends to a depth of about 5 inches, is yellowish brown silt loam. The subsoil, which extends to a depth of about 34 inches, is yellowish brown silt loam in the upper part and yellowish brown silty clay loam in the lower part. The substratum, which extends to a depth of 38 inches, is yellowish brown silt loam. Sandstone bedrock is at a depth of 38 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability and the available water capacity are moderate. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is moderately deep and easily penetrated by plant roots. Depth to bedrock ranges from 30 to 40 inches.

Included with this soil in mapping are small areas of Latham, Clarkrange, and Lily soils. Also included are small areas of a soil that is more than 40 inches deep to bedrock. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Wernock soil is used mainly as pasture, hay, or woodland. In some areas, it is used for row crops (fig. 19).

This soil is suited to row crops. Crops respond well to lime and fertilizer. Erosion is a moderate hazard, and measures to control it are needed if this soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

Figure 19.—Hay and corn are grown in this area of Wernock silt loam, 2 to 6 percent slopes.

This soil is well suited to hay and to use as pasture. Moderately high yields can be obtained if properly managed, but the moderately deep root zone and lack of moisture in dry seasons limit production. Plants that tolerate dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected. Pasture renovation, lime and fertilizer, proper stocking, rotation grazing, and control of undesirable species are also chief management needs.

This soil is suited to use as woodland, and the potential productivity for shortleaf pine is 110 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are eastern white pine, shortleaf pine, white oak, and northern red oak. Plant competition is a concern in management.

This soil is suited to some urban uses, but the moderate depth to bedrock is a severe limitation for most sanitary facilities and a moderate limitation for buildings with basements. Low strength is a limitation for local roads and streets and for roadfill. These limitations can be partly overcome by proper engineering techniques.

This Wernock soil is in capability subclass IIe.

WnC—Wernock silt loam, 6 to 12 percent slopes. This soil is moderately deep, well drained, and sloping. It is on ridgetops mainly in the northwest part of Knox County, but small areas occur throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 2 inches thick. The subsurface layer, which extends to a depth of about 5 inches, is yellowish brown silt loam. The subsoil, which extends to a depth of about 34 inches, is yellowish brown silt loam in the upper part and yellowish brown silty clay loam in the lower part. The substratum, which extends to a depth of 38 inches, is yellowish brown silt loam. Sandstone bedrock is at a depth of 38 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability and the available water capacity are moderate. This soil has good tilth and can be worked throughout a wide range of

moisture content. The root zone is moderately deep and easily penetrated by plant roots. Depth to bedrock ranges from 30 to 40 inches.

Included with this soil in mapping are small areas of Latham and Lily soils. Also included are small areas of a soil that is more than 40 inches deep to bedrock. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Wernock soil is used mainly as pasture, for hay, or as woodland. In some areas, it is used for row crops.

This soil is suited to row crops, but it is limited because erosion is a severe hazard. Crops respond well to lime and fertilizer. If this soil is cultivated, measures to control erosion are needed. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture. High yields can be obtained if properly managed, but the moderately deep root zone and the lack of moisture in dry seasons limits production. Plants that tolerate dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable species are also chief management needs.

This soil is suited to use as woodland, and the potential productivity for shortleaf pine is 110 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are eastern white pine, shortleaf pine, white oak, and northern red oak. Plant competition is a concern in management.

This soil is suited to some urban uses, but the moderate depth to bedrock is a severe limitation for most sanitary facilities and a moderate limitation for dwellings with basements. Low strength is a limitation for local roads and streets and for roadfill. These limitations can be partly overcome by proper engineering techniques.

This Wernock soil is in capability subclass IIIe.

WnD—Wernock silt loam, 12 to 20 percent slopes. This soil is moderately deep, well drained, and moderately steep. It is on ridgetops mainly in the northwest part of Knox County, but small areas occur throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 30 acres.

Typically, the surface layer is dark grayish brown silt loam about 2 inches thick. The subsurface layer, which extends to a depth of about 5 inches, is yellowish brown silt loam. The subsoil, which extends to a depth of about 34 inches, is yellowish brown silt loam in the upper part and yellowish brown silty clay loam in the lower part. The substratum, which extends to a depth of 38 inches, is yellowish brown silt loam. Sandstone bedrock is at a depth of 38 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid throughout except where lime has been added. Permeability and the available water capacity are moderate. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is moderately deep and easily penetrated by plant roots. Depth to bedrock ranges from 30 to 40 inches.

Included with this soil in mapping are small areas of Latham and Lily soils. Also included are small areas of a soil that is more than 40 inches deep to bedrock. The included soils make up about 10 percent of this map unit, but individual areas are generally less than 2 acres.

This Wernock soil is used mainly as woodland, pasture, or hay. In some small areas, it is used for row crops.

This soil is poorly suited to row crops because erosion is a severe hazard. Crops respond well to lime and fertilizer. If this soil is cultivated, contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is suited to hay and to use as pasture. Moderate yields can be obtained if properly managed, but the moderately deep root zone and lack of moisture in dry seasons limits production. Plants that tolerate dry conditions, produce adequate forage, and provide satisfactory ground cover should be selected. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable species are also chief management needs.

This soil is suited to use as woodland, and the potential productivity for shortleaf pine is 110 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are eastern white pine, shortleaf pine, white oak, and northern red oak. Plant competition, the erosion hazard, and equipment use limitations are concerns in management.

This soil is poorly suited to most urban uses because of the moderate depth to bedrock and moderately steep slopes. Low strength is a limitation for local roads and streets and for roadfill. These limitations can be partly overcome by proper engineering techniques.

This Wernock soil is in capability subclass IVe.

WtA—Whitley silt loam, 0 to 2 percent slopes, rarely flooded. This soil is deep, well drained, and nearly level. It is on stream terraces of major streams and their tributaries throughout the survey area. Individual areas are from 2 to 25 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 52 inches, is brownish yellow silty clay

loam in the upper part, yellowish brown silty clay loam in the middle part, and brownish yellow silt loam in the lower part. The substratum to a depth of about 72 inches is silt loam that is mottled in shades of yellow, brown, and gray.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. In most areas, this soil is subject to rare flooding. The chance of flooding is about once every 20 years. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Newark, Cuba, Stendal, Morehead, and Allegheny soils. Also included are a few small areas of a soil that has a thick, dark brown surface layer. The included soils make up about 15 percent of the map unit, but individual areas are generally less than 2 acres.

This Whitley soil is used mainly for row crops, hay, or pasture. In a few areas, it is used as homesites.

This soil is well suited to row crops and produces high yields if properly managed. Crops respond well to fertilizer and lime. Erosion is not a hazard, and this soil can be cropped year after year if good management practices are used to maintain fertility and organic matter content. Conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture. Plants that produce adequate forage and provide satisfactory ground cover should be selected. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland. The potential productivity for shortleaf pine is 114 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are shortleaf pine, eastern white pine, white oak, yellow-poplar, and black walnut. Plant competition is a concern in management.

This soil is suited to some urban uses, but the hazard of rare flooding is a severe limitation for dwellings. Low strength is a severe limitation for local roads and streets and for roadfill.

This Whitley soil is in capability class I.

WtB—Whitley silt loam, 2 to 6 percent slopes, rarely flooded. This soil is deep well drained, and gently sloping. It is on stream terraces of major streams and their tributaries throughout the survey area. Individual areas are 2 to 30 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 52 inches, is brownish yellow silty clay loam in the upper part, yellowish brown silty clay loam in the middle part, and brownish yellow silt loam in the lower part. The substratum to a depth of about 72 inches is silt loam that is mottled in shades of yellow, brown, and gray.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. In most areas, this soil is subject to rare flooding. The chance of flooding is about once every 20 years. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Newark, Cuba, Stendal, and Allegheny soils. Also included are small areas of a soil that has a thick, dark brown surface layer. The included soils make up about 15 percent of the map unit, but individual areas are generally less than 2 acres.

This Whitley soil is used mainly for row crops, hay, or pasture. In a few areas, it is used as homesites.

This soil is well suited to row crops and produces high yields if properly managed (fig. 20). Crops respond well to fertilizer and lime. Erosion is a moderate hazard, and measures to control it are needed if this soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture and produces high yields if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undersirable vegetation are also chief management needs.

This soil is suited to use as woodland. The potential productivity for shortleaf pine is 114 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are shortleaf pine, eastern white pine, white oak, yellow-poplar, and black walnut. Plant competition is a concern in management.

This soil is suited to some urban uses, but the hazard of flooding is a severe limitation for dwellings. Low strength is a limitation for local roads and streets and for roadfill.

This Whitley soil is in capability subclass IIe.

WtC—Whitley silt loam, 6 to 12 percent slopes, rarely flooded. This soil is deep, well drained, and sloping. It is on stream terraces of major streams and their tributaries throughout the survey area. Slopes are smooth and convex. Individual areas are 2 to 20 acres.

Figure 20.—Whitley silt loam, 2 to 6 percent slopes, rarely flooded, produces high yields of corn if properly managed.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil, which extends to a depth of about 52 inches, is brownish yellow silty clay loam in the upper part, yellowish brown silty clay loam in the middle part, and brownish yellow silt loam in the lower part. The substratum to a depth of about 72 inches is silt loam that is mottled in shades of yellow, brown, and gray.

This soil is medium in natural fertility and moderate in organic matter content. It is strongly acid or very strongly acid throughout except where lime has been added. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked throughout a wide range of moisture content. Most areas are subject to rare flooding. The chance of flooding is about once every 20 years. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Newark, Cuba, Stendal, and Allegheny soils. Also included are a few small areas of Whitley soil that has slopes of more than 12 percent. The included soils make up about 15 percent of this map unit, but individual areas are generally less than 2 acres.

This Whitley soil is used mainly as pasture or for hay. In some small areas, it is used for row crops, and in a few areas, it is used as homesites.

This soil is suited to row crops. Crops to respond well to fertilizer and lime. Erosion is a severe hazard, and measures to control it are needed if this soil is cultivated. Contour tillage, stripcropping, conservation tillage, return of crop residue to the soil, cover crops, and grasses and legumes in the cropping system help control erosion and maintain good tilth and the supply of organic matter.

This soil is well suited to hay and to use as pasture and produces high yields if properly managed. Management includes selecting plants that produce adequate forage and provide satisfactory ground cover. Pasture renovation needs to be frequent enough to

maintain the desired species. Lime and fertilizer, proper stocking, rotation grazing, and control of undesirable vegetation are also chief management needs.

This soil is suited to use as woodland. The potential productivity for shortleaf pine is 114 cubic feet per acre at the point of highest yearly growth. Preferred trees for planting are shortleaf pine, eastern white pine, white oak, yellow-poplar, and black walnut. Plant competition is a concern in management.

This soil is suited to some urban uses, but the hazard of flooding is a severe limitation for dwellings. Slope is a moderate limitation for small buildings and septic tank absorption fields. Low strength is a limitation for local roads and streets and for roadfill.

This Whitley soil is in capability subclass IIIe.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Knox County and the eastern part of Whitley County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Almost 49,000 acres, or more than 12 percent of the survey area meets the soil requirements for prime farmland. Prime farmland soils are scattered throughout the survey area, but most are in general map units 5, 6, 7, and 8. The main crops grown on the prime farmland are corn, tobacco, hay, and pasture.

A recent trend in land use in some parts of the survey area has been the conversion of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal land, which generally is more erodible, droughty, or difficult to cultivate, and less productive than prime farmland.

The following map units, or soils, make up prime farmland in Knox County and the eastern part of Whitley County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils that have limitations, such as a high water table or flooding, may qualify as prime farmland if these limitations are overcome by such measures as drainage or flood control. In the following list, the measures needed to overcome the limitations of a map unit, if any, are shown in parentheses after the map unit name. Onsite evaluation is necessary to determine if the limitations have been overcome by the corrective measures.

AlB Allegheny loam, 2 to 6 percent slopes

AnB Allegheny loam, 2 to 6 percent slopes, rarely flooded

Bo Bonnie silt loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)

ClB Clarkrange silt loam, 2 to 6 percent slopes

Co Cotaco loam, rarely flooded

Cu Cuba silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)

Hu Huntington silt loam, occasionally flooded

Mo Morehead silt loam, rarely flooded

Ne Newark silt loam, occasionally flooded (where drained)

Pg Pope gravelly fine sandy loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)

ShB Shelocta gravelly silt loam, 2 to 6 percent slopes
St Stendal silt loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)
Sv Stokly fine sandy loam, frequently flooded (where drained and protected from flooding or not frequently flooded during the growing season)
WnB Wernock silt loam, 2 to 6 percent slopes
WtA Whitley silt loam, 0 to 2 percent slopes, rarely flooded
WtB Whitley silt loam, 2 to 6 percent slopes, rarely flooded

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1967, 42,524 acres in Knox County and 50,543 acres in Whitley County were used for crops and pasture *(13)*. In Knox County, 14,260 acres was used for permanent pasture; 4,810 acres for row crops, mainly corn and tobacco; 11,133 acres for rotation hay and pasture; and 1,376 acres for hay. About 4,747 acres was in conservation use. Most of the remaining acreage was idle cropland.

Whitley County had 31,912 acres used for permanent pasture; 4,559 acres for row crops, mainly corn and tobacco; 6,029 acres for rotation hay and pasture; and 1,218 acres for hay. About 5,800 acres was in conservation use. The remaining acreage was mainly idle cropland. About 50 percent of the land used for crops and pasture in Whitley County is in the survey area.

The soils in the survey area are well suited to increased production of crops. About 25,000 acres of potentially good cropland is idle or is in pasture or woodland. In addition to the reserve productive capacity represented by this land, food production could be increased by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

The acreage of cropland and pasture has been decreasing as more and more land is used for urban development, is being surface-mined for coal, or is reverting to woodland. In 1980, there was about 12,455 acres of urban and built-up land in Knox County and 13,131 acres in Whitley County. Most of the urban and built-up land in Whitley County is in the survey area.

Soil erosion is the major concern on about 65 percent of the cropland and pasture in the soil survey area. If slope is more than 2 percent, erosion is a hazard. Allegheny, Latham, Lily, and Shelocta soils, for example, have slopes of more than 2 percent.

Erosion reduces productivity as the surface layer is lost and the subsoil is incorporated into the plow layer. This causes a loss of organic matter and plant nutrients. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Latham soils, and on

soils that have a layer in or below the subsoil that limits depth of the root zone. Such layers include a fragipan, as in Clarkrange soils, or bedrock, as in Wernock and Lily soils.

Soil erosion on farmland also results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, recreation, and for use by fish and wildlife.

Erosion control provides protective surface cover, reduces runoff, and increases infiltration. A cropping system that keeps vegetative cover on the soil for extended periods generally can hold soil erosion losses to amounts that will not reduce the productivity of the soil. A complete cropland resource management system includes such practices as contour farming, terracing, contour stripcropping, use of diversions and grassed waterways, conservation tillage, effective crop residue management, seeding cover crops, grasses and legumes in the rotation, and applying fertilizer as needed. Technical information on conservation practices is available from local offices of the Soil Conservation Service.

Soil drainage is the main management need on many of the soils on the flood plains and terraces in the survey area (fig. 21). Nearly 48,000 acres of soils in the survey area are on flood plains and terraces. About 61 percent of these soils are somewhat poorly drained and 6 percent are poorly drained to very poorly drained. Some soils are so wet in their natural state that production of crops common to the area is not feasible. The Bonnie soils are in this category and are poorly drained to very poorly drained (fig. 22).

Soils that are somewhat poorly drained are so wet that crops are damaged in most years unless the soils are artificially drained. In this group are the Stendal, Newark, and Stokly soils on flood plains and the Morehead and Cotaco soils on stream terraces. Open ditches and tile drains are the most commonly used systems to remove excess water. The design and system used vary with the kind and use of the soil. Tile drains are more expensive to install, but they generally provide better drainage than open ditches. A combination of surface drainage and tile drainage is needed in some areas. For drainage by either tile or open ditches, suitable outlets are required. Information on designing a drainage system is available at local offices of the Soil Conservation Service.

Soil fertility is naturally low in about half of the soils in the survey area. Huntington, Newark, and Bledsoe soils are high in natural fertility, and Allegheny, Cotaco, Cuba, Lily, Pope, Shelocta, and Whitley soils have less natural fertility. All of the soils in the survey area range from strongly acid to extremely acid in their natural state except Huntington, Newark, Bledsoe, and Fairpoint soils, which range from medium acid to mildly alkaline. Most of the soils need lime or fertilizer, or both, to improve soil fertility. The amounts needed depend on the natural content of lime and the natural fertility level, on past cropping and management, on the needs of the crop, and on the yield level desired. Additions of lime and fertilizer on all soils should be based on the results of soil tests. The local offices of the Cooperative Extension Service can help to determine the kinds and amounts of lime and fertilizer to apply.

Soil tilth is an important factor in seed germination and permeability. Soils that are friable, granular, and porous have good tilth. On such soils, the movement of air and water is not restricted. Root penetration and shoots emerge more easily in soils that have good tilth. Most of the soils in the survey area that are used for crops have a granular and porous silt loam or loam surface layer. However, in areas that are continually row cropped, the soil structure may be damaged and the organic matter may be depleted. If the soil structure is broken down, the soil's ability to provide the proper combination of air and water to plants is hindered. In these areas, tillage for seedbed preparation should be kept to a minimum because it breaks down soil structure. Adding organic matter, such as having grasses and legumes in the rotation, helps maintain soil structure and good tilth. Many soils in the survey area have a light color surface layer and are low in organic matter content. Erosion control, the addition of farm manure, crop residue left on the soil, cover crops, and grasses and legumes help maintain or increase the organic matter content.

Field crops suited to the soils and climate of the survey area include many that are not commonly grown. Row crops of corn and burley tobacco are common. A small acreage of soybeans and small grains are grown, and the acreage could be expanded by double cropping, such as following small grain with soybeans, and by no-till farming. Grass seed can be produced from fescue, orchardgrass, and timothy.

Special crops grown in the survey area are vegetables, small fruits, tree fruits, and nursery plants. A small acreage is used for tomatoes, strawberries, raspberries, melons, sweet corn, peppers, cabbage, and other vegetables and small fruits. Apples and peaches are the most important tree fruit in the survey area.

Deep soils that have good natural drainage and warm up early in the spring are especially well suited to vegetables and small fruits, if flooding is not a hazard. In the survey area, these are the Allegheny and Shelocta soils that have slopes of less than 6 percent. Crops can generally be planted and harvested earlier on these soils than on other soils in the survey area.

Most of the well drained soils in the survey area are suitable for vegetables, orchards, and nursery plants. Soils in low positions where frost is frequent and air drainage is poor generally are poorly suited to early vegetables, small fruits, and orchards.

Figure 21.—This area of undrained Newark silt loam, occasionally flooded, is idle. The corn is on Huntington silt loam, occasionally flooded. The Newark soil is suited to use as cropland if it is drained.

Pasture and Hayland

Henry Amos, conservation agronomist, and Carl W. Hail, assistant state soil scientist, Soil Conservation Service, helped prepare this section.

A successful livestock program is dependent on a forage program that supplies large quantities of home-grown feeds of adequate quality. Such a program can furnish up to 78 percent of the feed for beef and 66 percent for dairy cattle *(10)*.

In Knox County and the eastern part of Whitley County, about 44,000 acres is used for hay and pasture. About 7,400 acres needs reestablishment; a sizeable acreage needs improvement, brush control, and protection from overgrazing.

The soils in the survey area vary widely in their capabilities and properties because of differences in depth to bedrock or limiting layers, internal drainage, ability to supply moisture, and many other properties. Grasses and legumes and grass-legume combinations

Figure 22.—Rushes and other wetland plants grow well in an area of undrained Bonnie silt loam. This soil is suited to use for crops and pasture only if it is drained.

vary widely in their ability to persist and produce on different soils. The plant species or mixture of species should be matched to the different soils so that the greatest returns can be realized along with maximum soil and water conservation (fig. 23).

Soils that are level to gently sloping, deep, and well drained should be used for the highest producing crops, such as corn, silage, alfalfa, or a mixture of alfalfa-orchardgrass or alfalfa-timothy. To minimize soil erosion, soils that are moderately steep to steep should be maintained in sod-forming grasses such as tall fescue. Alfalfa should be used with a cool-season grass where the soils are at least 2 feet deep and well drained. Soils that are less than 2 feet deep, or that are not well drained, can be used for clover-grass mixtures or pure grass stands. Legumes can be established in grass-dominant sods through renovation.

Plants need to be adapted not only to the soil but also to the intended use. Selected plants should provide maximum quality and versatility in the forage program. Legumes should be used to the maximum extent possible because they generally produce higher quality feed than grasses. This results in higher animal performance. Taller-growing legumes, such as alfalfa

Figure 23.—Grass and legume pastures produce high yields in this area of Allegheny loam, 2 to 6 percent slopes.

and red clover, are more versatile than a legume such as white clover, which is used primarily for grazing. Grasses, such as orchardgrass, timothy, and tall fescue, are better adapted for hay and silage.

Tall fescue is an important cool-season grass suited to a wide range of soil conditions. It is used for both pasture and hay. Growth that occurs during August to November is commonly permitted to accumulate in the field and is "stock-piled" for deferred grazing late in fall and in winter. Nitrogen fertilizer is important for maximum production during the stockpiling period. The desired production levels should determine the rate of application.

Renovation is one way to increase the yields of pasture and hay fields that have a good stand of grass. Renovation is the improvement of pasture and hay fields by partial destruction of the sod, plus liming, fertilizing, and seeding to reestablish desirable forage plants. Adding legumes to these grass fields provides high quality feed and increases summer production. Legumes also add nitrogen to the soil. Under Kentucky growing conditions, alfalfa can fix 200 to 300 pounds of nitrogen per acre every year, red clover 100 to 200 pounds, and Ladino clover 100 to 150 pounds. An acre of Korean lespedeza, vetch, and other annual forage legumes can fix 75 to 100 pounds of nitrogen per year *(11)*.

Some important steps in successful renovation and management are:

- Graze or mow closely before disking or disturbing the sod.
- Disturb 40 to 60 percent of the grass for clovers and 80 to 100 percent for alfalfa. A disk, field cultivator, or field tiller can be used.
- Test the soil to determine the amount of lime, phosphate, and potash to be applied. Do not use nitrogen in renovating old grass fields because nitrogen increases grass competition to the legume seedlings.

- •Prepare a smooth, firm seedbed and distribute the seed evenly over the area, covering the seed about 1/8 to 1/4 inch deep to assure good contact between seed and soil.
- •Seed an adapted variety that has a high percent germination and inoculate with the proper nitrogen-fixing bacteria.
- •Seed fescue, bluegrass, timothy, orchardgrass, ryegrass, and small grains for forage late in summer or early in fall. Alfalfa, red clover, white clover, and lespedeza are usually most successful in spring.
- •Keep renovated fields grazed short until livestock start grazing the young legumes; then remove the livestock and allow the legumes to become established.
- •Control grazing so that 2 to 3 inches of top growth is left on established grass-legume mixtures.
- •Mow pastures as needed to remove grass seedheads and to control weeds and woody vegetation.
- •Topdress annually with phosphate and potash according to soil tests and add lime to maintain soil pH needed by the legume that is being grown.
- •Check renovated fields for insect damage or disease.

Additional information on pasture and hayland management is available from local offices of the Soil Conservation Service or the Kentucky Cooperative Extension Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode, but they have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or

c, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class I because the soils of this class have few limitations. The soils in class V are subject to little or no erosion, but they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation. Class V contains only the subclasses indicated by *w, s,* or *c*.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Woodland Management and Productivity

Charles A. Foster, forester, Soil Conservation Service, prepared this section.

The past history of Knox County and the eastern part of Whitley County has been typical of much of Appalachia. The original forest was well stocked with trees. Except for the American chestnut, which has largely disappeared because of blight, the species were the same as today. However, there was a higher proportion of better quality large trees of more valuable species.

Early settlers saw the forest as a hindrance to farming and a hiding place for hostiles. They cleared and burned as much of the forest as they were able. Following the Civil War, northern and eastern speculators became interested in the timber, and logging boomed. The state ranked 15th in total timber production. This boom peaked in 1907 and by 1925 had become a bust. Sawmills shut down, and people who had come in with the big companies moved on to new areas. Those who remained turned to the land for a living. Most bottom land was occupied, and people were forced to clear steep slopes for corn crops. The depression of the 1930's accelerated land clearing. People moved from industrial areas to the hills to live through hard times.

After the Second World War, many families and workers moved to northern industrial states where employment opportunities were better. This trend continued into the 1960's, leaving a sizeable acreage of idle land. Nature's healing process was accelerated by a strong tree planting program implemented by state and federal agencies during the late 50's and early 60's. From 1949 to 1963, the forest acreage in Knox County increased by 16 percent and by 7 percent in Whitley County. The forest acreage increased only slightly in Whitley County from 1963 to 1978 and increased about 4 percent in Knox County as idle acres became established in woody growth. Also about this time, strip mining began to replace deep mining as the method of coal extraction. The mined acreage in both counties is large and occurs mostly on forested landscapes.

The survey area has about 300,000 acres of commercial forest land covering 78 percent of the land area *(19)*. The average size of private ownerships in Kentucky is 24 acres and forest growth averages 32 cubic feet per acre per year, which is well below the potential of most sites. The most important reason for the low growth is that most privately-owned forest lands are not well stocked with desirable high quality trees. Past cuttings have taken the best trees, leaving the worst.

Forests in these two counties are in the mixed mesophytic region of the Eastern Deciduous Forest. They are characterized by a wide variety of species both in the understory and overstory. The complexity of species varies in composition with changes in aspect and relationship of water and soil. Over 40 commercial species are in the counties, and there are at least as many noncommercial trees and shrubs. The two dominant timber types are the oak-hickory and central mixed hardwoods, which make up about 76 percent of the forest acreage. Lesser types include the southern pine, oak-pine, white oak, and maple-beech types. Conspicuous types in the forest understory include the rhododendron or fern ephemerals on moist sites and the mountain laurel or blueberry-huckleberry on dry sites.

Woodland management. The large, privately-owned forest acreage in the survey area is divided among many owners. Most of these holdings are not managed for wood crop production. Instead, they are held for their beauty, wildlife values, or underlying coal reserves, or the woodland just happens to be a part of the landholding.

Knox County has five commercial sawmills and one pallet mill. Whitley County has four commercial sawmills and a pulpwood yard. Products produced include rough lumber, crossties, framing, dimension stock, flooring lumber, chips, mine materials, and cants. Mills in adjoining counties also purchase timber from the survey area.

Woodland owners should know the capability of soils for different land uses. This knowledge might deter some owners from clearing woodland for uses for which the soil is not suited. Large areas of woodland in Knox and Whitley Counties, once cleared for cropland or pasture, have eroded rapidly, eliminating most of the natural topsoil.

The soil survey and its accompanying interpretations, including the soil-woodland rating system, is the basic technical material used in planning woodland. Each soil has a characteristic profile; it also occurs in a characteristic landscape position, supports a unique

Figure 24.—Yellow-poplar is one of the preferred trees to plant on north slopes of Shelocta gravelly silt loam, 12 to 20 percent slopes.

natural plant community, and has definable potentials and limitations for a variety of land uses. The soil profile is a reflection of complex interactions of soil, climate, and vegetative regimes.

In defining soil map units, soil scientists not only measure and classify the soil's properties but also consider practical needs for land use and management. Map units are defined, therefore, to supply information about land form and slope position. This information is important in understanding the woodland site.

Potential productivity. The most recognized soil-woodland interpretation is that of productivity, generally stated in terms of site index *(3)* or the average height, in feet, that dominant and codominant trees in this survey area attain in 50 years. Site index applies to fully stocked, even-aged, unmanaged stands. The utility of this interpretation is obvious because land of high productivity generally offers better economic opportunity than does land of low productivity, other things being equal. Woodland of several levels of productivity could require different levels of management, the best land

justifying the greater effort and the poorest land, protection only.

The most significant factors affecting site productivity (site index) are soil texture, depth, pH, available water, and topographic factors, such as slope position, percent slope, and aspect (direction the slope faces). The actual amount of water in the soil during the growing season appears to be more closely related to tree growth than the available water capacity.

The highest site index values are on north- and east-facing slopes (azimuth 315-135), the lower third of hot or south- and west-facing slopes (azimuth 135-315), and the bottoms, as opposed to ridgetops, and upper two-thirds of south- and west-facing slopes. Differences in site index amount to as much as 10 feet.

Soils on cool slopes generally have a somewhat lower mean annual temperature, have more organic matter creating a darker color, hold more water during periods of stress, and receive less solar radiation in comparison to hot slopes. These characteristics provide a high potential productivity for high quality trees.

Soils on south- and west-facing slopes and ridgetops tend to be lighter in color, more acid, and have less organic matter than cool slopes. Hot slopes have more wind movement and solar radiation, higher air and soil temperatures, and therefore, increased evapo-transpiration and water loss from the upper part of the soil than do cool slopes. The result is slower growth rates and generally poorer quality trees on hot slopes.

The common overstory plants on cool-facing slopes and in coves are yellow-poplar, red maple, white oak, chestnut oak, shortleaf pine, Virginia pine, sweet birch, American beech, scarlet oak, black oak, shagbark hickory, blackgum, sweetgum, pitch pine, sassafras, and magnolias. The common understory plants on these sites are red maple, flowering dogwood, Christmas fern, wild yam, poison ivy, greenbrier, sassafras, false Solomon's seal, wahoo, stonecrop, cinquefoil, yellow-poplar, eastern redbud, white oak, black oak, wild ginger, may-apple, slippery elm, partridge-berry, sourwood, chestnut oak, alum-root, violet, hog-peanut, blackgum, blue-beech, New York fern, Solomon's seal, black cherry, spotted wintergreen, American beech, dwarf iris, Jack-in-the-pulpit, spicebush, white baneberry, maiden hair fern, hophornbeam, wild grape, and shortleaf pine.

The common overstory plants on hot-facing slopes and ridgetops are the white oak, scarlet oak, black oak, chestnut oak, shortleaf pine, red maple, pignut hickory, shagbark hickory, American beech, sugar maple, post oak, pitch pine, and blackgum.

The common understory plants on these sites are red maple, greenbrier, blackgum, sassasfras, flowering dogwood, black oak, sourwood, wild grape, blueberry, white oak, chestnut oak, tick-trefoil, red maple, spotted wintergreen, white oak, loosestrife, mountain laurel, pignut hickory, trailing arbutus, rattlesnake plantain, cinquefoil, Solomon's seal, Christmas fern, and eastern redbud.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to fertilization than others, some are more susceptible to landslides and erosion after building roads and harvesting timber, and some require special efforts to reforest. In the section "Detailed soil map units," each map unit in the survey area suitable for producing timber presents information about productivity, limitations for harvesting timber, and management concerns for producing timber. Table 7 summarizes this forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate*, and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

The first tree listed for each soil under the column "Common trees" is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

Ratings of the *erosion hazard* indicate the probability that damage may occur if site preparation activities or harvesting operations expose the soil. The risk is *slight* if no particular preventive measures are needed under ordinary conditions; *moderate* if erosion control measures are needed for particular silvicultural activities; and *severe* if special precautions are needed to control erosion for most silvicultural activities. Ratings of *moderate* or *severe* indicate the need for construction of higher standard roads, additional maintenance of roads, additional care in planning of harvesting and reforestation operations, or use of specialized equipment.

Ratings of *equipment limitation* indicate limits on the use of forest management equipment, year-round or seasonal, because of such soil characteristics as slope, wetness, stoniness, or susceptibility of the surface layer to compaction. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On the steeper slopes, tracked equipment must be used. On the steepest slopes, even tracked equipment cannot operate; more sophisticated systems are needed. The rating is *slight* if equipment use is restricted by soil wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if slopes are steep enough that wheeled equipment cannot be operated safely across the slope, if soil wetness restricts equipment use from 2 to 6 months per year, if stoniness restricts ground-based equipment, or if special equipment is needed to avoid or reduce soil compaction. The rating is *severe* if slopes are steep enough that tracked equipment cannot be operated safely across the slope, if soil wetness restricts equipment use for more than 6 months per year, if stoniness restricts ground-based equipment, or if special equipment is needed to avoid or reduce soil compaction. Ratings of *moderate* or

severe indicate a need to choose the most suitable equipment and to carefully plan the timing of harvesting and other management operations.

Ratings of *seedling mortality* refer to the probability of death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall as influenced by kinds of soil or topographic features. *Seedling mortality* is caused primarily by too much water or too little water. The factors used in rating a soil for seedling mortality are texture of the surface layer, depth and duration of the water table, rock fragments in the surface layer, rooting depth, and the aspect of the slope. Mortality generally is greatest on soils that have a sandy or clayey surface layer. The risk is *slight* if, after site preparation, expected mortality is less than 25 percent; *moderate* if expected mortality is between 25 and 50 percent; and *severe* if expected mortality exceeds 50 percent. Ratings of *moderate* or *severe* indicate that it may be necessary to use containerized or larger than usual planting stock or to make special site preparations, such as bedding, furrowing, installing surface drainage, or providing artificial shade for seedings. Reinforcement planting is often needed if the risk is *moderate* or *severe*.

Ratings of *plant competition* indicate the likelihood of the growth or invasion of undesirable plants. *Plant competion* becomes more severe on the more productive soils, on poorly drained soils, and on soils having a restricted root zone that holds moisture. The risk is *slight* if competition from undesirable plants reduces adequate natural or artificial reforestation but does not necessitate intensive site preparation and maintenance. The risk is *moderate* if competition from undesirable plants reduces natural or artificial reforestation to the extent that intensive site preparation and maintenance are needed. The risk is *severe* if competition from undesirable plants prevents adequate natural or artificial reforestation unless the site is intensively prepared and maintained. A *moderate* or *severe* rating indicates the need for site preparation to ensure the development of an adequately stocked stand. Managers must plan site preparation measures to ensure reforestation without delays.

The potential productivity of *common trees* on a soil is expressed as a *site index*. Common trees are listed in the order of their observed general occurrence. Generally, only two or three tree species dominate.

The soils that are commonly used to produce timber have the yield predicted in cubic feet and cubic meters. The yield is predicted at the point where mean annual increment culminates.

The *site index* is determined by taking height measurements and determining the age of selected trees within stands of a given species. This index is the average height, in feet, that the trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands. The procedure and technique for doing this are given in the site index tables used for the Knox County and eastern part of Whitley County soil survey *(3, 4, 5, 6, 7, 8, 9, 21, 22)*.

The *productivity* represents an expected volume produced by the most important trees, expressed in cubic feet per acre per year. Cubic feet per acre can be converted to board feet per acre by multiplying by a factor of about 5.

Trees to plant are those that are used for reforestation or, if suitable conditions exist, natural regeneration. They are suited to the soils and will produce a commercial wood crop. Desired product, topographic position (such as a low, wet area), and personal preference are three factors of many that can influence the choice of trees to use for reforestation.

Recreation

In table 8, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines (fig. 25). The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or

Figure 25.—This commercial pay lake was constructed for fishing. It is in an area of Shelocta-Latham silt loams, 30 to 60 percent slopes.

no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

William H. Casey, biologist, Soil Conservation Service, prepared this section.

The wildlife population of Knox and Whitley Counties consists of an estimated 43 species of mammals, 48 species of terrestrial reptiles and amphibians, and 87

species of birds that are either summer or year-round residents. Many of the more than 200 other species of birds that visit Kentucky each year can be found in these counties during certain seasons.

The wildlife most important are those that furnish recreation in the form of sport hunting, economic gain in the form of commercial trapping, and aesthetic enjoyment in the form of observing or photographing. Also of concern are those species thought to be in danger of extinction.

In Knox and Whitley Counties, the species most hunted are the gray squirrel, ruffed grouse, and raccoon. Trapping effort is concentrated on mink, muskrat, and foxes. Photographers and birdwatchers are especially interested in rare or unusual species that are seldom seen or difficult to approach. The red-cockaded woodpecker and the Indiana bat, whose ranges include Knox and Whitley Counties, are on the U.S. Fish and Wildlife Service's list of endangered species.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, ragweed, and frostweed astor.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and huckleberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, and silky dogwood.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and hemlock.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, and sedges.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes and swamps.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with

grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet, and because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations must be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to: evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family

dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered

daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches

of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant-available nutrients as it decomposes.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones, boulders, or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area, or from nearby areas, and on field examination.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They influence the soil's absorption of cations, moisture retention, shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). *common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and

on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 17 and the results of chemical analysis in table 18. The data are for soils sampled at carefully selected sites. Most pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Kentucky Agricultural Experiment Station.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(25)*.

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all materials less than 75 mm (3B1).
Sand—(0.05-2.0 mm fraction) weight percentages of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all materials less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of materials less than 2 mm (3A1).
Organic carbon—dichromate, ferric sulfate titration (6A1a).
Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2), magnesium (602), sodium (6P2), potassium (6Q2).
Extractable acidity—barium chloride-triethanolamine I (6H1a).
Cation-exchange capacity—ammonium acetate, pH 7.0 (5A1a).
Cation-exchange capacity—sodium acetate, pH 8.2 (5A2a).
Cation-exchange capacity—ammonium chloride (5A7a).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1a).
Reaction (pH)—potassium chloride (8C1c).
Available phosphorus—(method of reporting laboratory). Procedure (656) Kentucky Agricultural Experiment Station.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. Most pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by Soil Mechanics Laboratory, South National Technical Center, Fort Worth, Texas.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(24)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, acid, mesic Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the substratum within a series. An example is the Bonnie series, which is a member of fine-silty, mixed, acid, mesic family of Typic Fluvaquents.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (23)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (24)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Allegheny Series

The Allegheny series consists of deep, well drained, moderately permeable soils that formed in loamy alluvium from acid sandstone, siltstone, and shale. These gently sloping to moderately steep soils are on stream terraces and alluvial fans of major streams and their tributaries throughout the survey area. Some Allegheny soils on low stream terraces are subject to rare flooding in winter and spring. Slopes range from 2 to 20 percent.

Allegheny soils are on similar landscapes as those of Cotaco, Whitley, Wernock, and Latham soils. Cotaco soils are not as well drained as the Allegheny soils. Whitley and Wernock soils have a fine-silty control section, and Latham soils have a clayey control section.

Typical pedon of Allegheny loam, 6 to 12 percent slopes; in a pasture, 1,000 feet southeast of Himyar on Swanson Cemetary Road; 500 feet north of the cemetery, 550 feet south of Kentucky Highway 930; and 2,000 feet east of the Cumberland River; in Knox County.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam; moderate fine granular structure; very friable; medium acid; abrupt smooth boundary.

B1—8 to 16 inches; yellowish brown (10YR 5/6) loam; moderate fine medium and coarse subangular blocky structure; friable; 2 percent rounded quartz pebbles; very strongly acid; gradual smooth boundary.

B21t—16 to 26 inches; strong brown (7.5YR 5/6) loam; moderate medium and coarse subangular blocky structure; friable; thin patchy clay films; very strongly acid; gradual smooth boundary.

B22t—26 to 36 inches; strong brown (7.5YR 5/6) clay loam; moderate medium and coarse subangular blocky structure; friable to firm; common clay films on faces of peds and in root channels; few 15- to 25-millimeter sand pockets; very strongly acid; gradual smooth boundary.

B23t—36 to 54 inches; strong brown (7.5YR 5/8) clay loam; many medium distinct red (2.5YR 4/6) and light red (2.5YR 6/6) mottles; moderate fine and medium subangular blocky structure; friable to firm; few 15- to 25-millimeter sand pockets; thin patchy clay films; very strongly acid; gradual smooth boundary.

C—54 to 94 inches; mottled reddish yellow (7.5YR 6/6), very pale brown (10YR 8/3), olive yellow (2.5Y 6/6), red (2.5YR 5/8), dark red (2.5YR 3/6), and white (10YR 8/1) clay loam; massive; friable to firm; few 15- to 25-millimeter sand pockets; very strongly acid.

Depth to bedrock ranges from 60 to 120 inches or more. Reaction ranges from strongly acid to extremely acid except where lime has been added.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. When the value is 3, the horizon is less than 5 inches thick.

The B1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. Texture ranges from fine sandy loam to silt loam. Some pedons do not have a B1 horizon.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 5, and chroma of 4 to 8. Mottles are in shades of red, brown, or yellow. Some pedons contain gray or olive mottles below the upper 24 inches of the argillic horizon. Texture is loam, sandy loam, sandy clay loam, clay loam, or their gravelly analogs.

The C horizon is mottled in shades of brown, yellow, gray, red, white, and olive. Texture is the same as that of the Bt horizon.

Bethesda Series

The Bethesda series consists of deep, well drained soils that have moderately slow permeability. The soils formed in acid regolith from surface mine operations. They are nearly level to very steep and are on ridgetops, benches, side slopes, terraces, and flood plains. Slopes range from 0 to 70 percent.

Bethesda soils are on the same landscape with Fairpoint, Latham, Shelocta, Wernock, DeKalb, Stendal, Bonnie, and Morehead soils. Fairpoint soils, which are intermingled with Bethesda soils, are nonacid and are formed primarily from neutral or calcareous shale. Latham soils, which are on ridgetops and upper side slopes, have a clayey control section. Shelocta soils, which are on lower side slopes, have an argillic horizon, and the solum is 40 to 60 inches thick. Wernock soils, which are on upland ridgetops, are moderately deep and have a fine-silty control section. Stendal and Bonnie soils are somewhat poorly drained and poorly drained, bottom land soils. Morehead soils, which are on terraces, have an argillic horizon and are somewhat poorly drained to moderately well drained.

Typical pedon of Bethesda channery silt loam, from an area of Fairpoint and Bethesda soils, 0 to 20 percent slopes; 1,000 feet northeast of a house, 2 miles up Gregory Branch, 0.5 mile south of Artemus, in Knox County.

AP—0 to 12 inches; dark grayish brown (10YR 4/2) channery silt loam; common medium distinct yellowish brown (10YR 5/6) pockets; moderate fine and medium angular blocky and relict platy structure; friable; common fine roots; few fine pores; 20 percent randomly oriented shale and sandstone fragments 0.1 inch to 3 inches across; medium acid; clear smooth boundary.

C1—12 to 36 inches; yellowish brown (10YR 5/6) very channery loam; 25 percent light brownish gray (10YR 6/2) pockets; massive; firm; few fine roots; 40 percent siltstone, sandstone, and shale fragments 0.1 inch to 3 inches across; strongly acid; gradual wavy boundary.

C2—36 to 58 inches; coarsely mottled yellowish brown (10YR 5/4) and olive gray (5Y 5/2) very channery loam; massive; firm; few fine roots; 45 percent soft siltstone, sandstone, and shale; some buried brush and pieces of lumber; very strongly acid; gradual smooth boundary.

C3—58 to 72 inches; coarsely mottled gray (5Y 5/1) and pale olive (5Y 6/3) very channery loam; massive;

firm; 50 percent soft sandstone; some micaceous siltstone and shale; very strongly acid.

Depth to bedrock is more than 60 inches. Reaction ranges from strongly acid to extremely acid except where lime has been added. Coarse fragments include sandstone, siltstone, shale, and coal. They range to 10 inches across, but include stones and boulders. Fragments of rock range from 35 to 80 percent, by volume, but average about 50 percent.

The A horizon has hue of 10YR to 2.5Y, value of 4 to 6, and chroma of 1 to 8. It is channery, shaly, gravelly, or stony phases of silty clay loam, clay loam, silt loam, or loam.

The C horizon has hue of 7.5YR to 5Y, value 3 to 6, and chroma of 1 to 6; or it is neutral (N) and has value of 3 to 6. This horizon is gravelly, very gravelly, shaly, very shaly, channery, and very channery loam, silt loam, clay loam, or silty clay loam.

Bledsoe Series

The Bledsoe series consists of deep, well drained soils that have moderately slow permeability. The soils formed in colluvium primarily from limestone, but a minor component washed from soils derived from siltstone, sandstone, and shale. The soils are moderately steep to very steep and are on side slopes and benches on the north side of Pine Mountain in Whitley County. Slopes range from 15 to 60 percent.

Bledsoe soils are on the same landscape with Shelocta soils and limestone Rock outcrop. The Shelocta soils have a fine-loamy control section and are more acid throughout.

Typical pedon of Bledsoe gravelly silt loam, from an area of Bledsoe-Shelocta-Rock outcrop complex, 15 to 90 percent slopes; in a wooded area on north side of Pine Mountain, 3,000 feet northeast of Henry Bowling Gap; 1,900 feet east of Kentucky Highway 1595; 2.3 miles southeast of Poplar Creek Church, 1.4 miles south of confluence of Doolin Branch and Poplar Creek, 700 feet north of Bell County line, 2.5 miles south of Siler, in Whitley County.

O1—1 to 0 inch; partly decomposed leaf litter.

A1—0 to 6 inches; dark brown (10YR 3/3) gravelly silt loam; weak fine granular structure; very friable; common fine and medium roots; 25 percent limestone and sandstone fragments; neutral; clear smooth boundary.

B1—6 to 26 inches; dark brown (7.5YR 4/4) gravelly silty clay loam; moderate medium subangular blocky structure; friable; common fine and medium roots; 24 percent limestone and sandstone fragments; mildly alkaline; clear smooth boundary.

B21t—26 to 36 inches; dark brown (7.5YR 4/4) silty clay loam; moderate medium and fine subangular blocky structure; firm; few fine and medium roots; few thin patchy clay films on peds and in root channels; 10 percent limestone and sandstone fragments; neutral; clear smooth boundary.

B22t—36 to 52 inches; strong brown (7.5YR 5/6) silty clay; moderate medium and fine angular and subangular blocky structure; firm; few medium roots; common clay films on peds; 5 percent limestone and sandstone fragments; neutral; gradual smooth boundary.

B3—52 to 58 inches; brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; firm; few clay films; 10 percent limestone, sandstone, and chert fragments; slightly acid; gradual smooth boundary.

C—58 to 62 inches; strong brown (7.5YR 4/6) silty clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; massive; very firm; 15 percent limestone, sandstone, and chert fragments; slightly acid.

Depth to bedrock or soft shale is more than 60 inches. Reaction ranges from slightly acid to mildly alkaline. Coarse fragments of limestone, sandstone, siltstone, and chert range from 5 to 35 percent in the solum and from 5 to 40 percent in the C horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silty clay or their gravelly, cobbly, channery, or flaggy analogs.

The C horizon has the same colors and textures as the B horizon but also includes clay. It has mottles in shades of brown, gray, or red. Some pedons have a IIC horizon weathered from soft shale.

Bonnie Series

The Bonnie series consists of deep, poorly drained soils that have moderately slow permeability. The soils formed in alluvium from soils derived from siltstone, sandstone, and shale. These nearly level or depressional soils are on flood plains. They are subject to frequent flooding of very brief duration during the winter and spring. They are saturated in the winter and spring and have a seasonal high water table at or near the surface.

Bonnie soils are on similar landscape with Stendal, Newark, and Morehead soils. Stendal and Newark soils are on flood plains and are somewhat poorly drained. Morehead soils are on adjacent stream terraces and are somewhat poorly drained to moderately well drained.

Typical pedon of Bonnie silt loam, frequently flooded; 1.5 miles north of Heidrick, 800 feet east of Richland Creek, 200 feet west of Kentucky Highway 229, 1,000 feet northeast of confluence of Horse Hollow and Richland Creek, in Knox County.

Ap—0 to 7 inches; gray (10YR 5/1) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles and few fine distinct reddish brown (5YR 5/3) mottles in root channels; weak fine and medium granular structure; friable; many fine and medium roots; medium acid; gradual smooth boundary.

B1g—7 to 18 inches; light olive gray (5Y 6/2) silt loam; common fine distinct olive brown (2.5Y 4/4) mottles in interior of peds and on surface of root channels; moderate medium subangular blocky structure; friable or firm; common fine roots; very strongly acid; gradual smooth boundary.

C1g—18 to 26 inches; gray (5YR 5/1) silt loam; common medium and coarse prominent olive brown (2.5Y 4/4) mottles in interior of peds and few coarse faint yellow (2.5Y 7/6) mottles; massive; firm; few fine and medium roots; strongly acid; gradual smooth boundary.

C2g—26 to 39 inches; gray (5Y 6/1) silty clay loam; common coarse distinct dark brown (7.5YR 4/4) mottles; massive; firm; few fine and medium roots; strongly acid; gradual smooth boundary.

C3g—39 to 54 inches; gray (5Y 6/1) silt loam; common fine, medium, and coarse distinct reddish yellow (7.5YR 6/8) mottles; massive; firm; extremely acid; clear smooth boundary.

C4g—54 to 64 inches; light gray (5Y 7/1) silt loam; common coarse distinct reddish yellow (7.5YR 6/8) mottles and very pale brown (10YR 7/3) mottles; massive; firm; few fine black concretions; extremely acid.

Depth to bedrock is 60 to 120 inches or more. Reaction is strongly acid or very strongly acid within 40 inches of the surface.

The A horizon has hue of 10YR or 5Y, value of 4 to 6, and chroma of 1 or 2. Mottles are in shades of gray, brown, yellow, and red.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7, and chroma of 1 or 2. The upper part of the control section is silt loam, and the lower part is silt loam or silty clay loam. In places, the C horizon contains sandy strata.

Clarkrange Series

The Clarkrange series consists of deep, moderately well drained soils that have moderate permeability in horizons above the fragipan and slow permeability in the fragipan. The soils formed in silty residuum from acid sandstone, siltstone, and shale. These gently sloping soils are on upland ridgetops. Slopes range from 2 to 6 percent.

Clarkrange soils are on the same landscape with Wernock and Latham soils. The Wernock and Latham soils do not have a fragipan. Wernock soils are well drained, and Latham soils have a clayey control section.

Typical pedon of Clarkrange silt loam, 2 to 6 percent slopes; in Corbin in an abandoned trailer park, 2,000 feet south of U.S. Highway 25E; 1,600 feet north of old U.S. Highway 25E; behind Trademart Shopping Center, in Knox County.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak fine and medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

B21t—8 to 18 inches; yellowish brown (10YR 5/6) silt loam; weak medium and coarse subangular blocky structure; friable; few fine roots; thin clay films on most peds; slightly acid; clear smooth boundary.

B22t—18 to 26 inches; brownish yellow (10YR 6/6) silt loam; few medium faint yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; thin clay film on most peds and pores; very strongly acid; clear smooth boundary.

Bx1—26 to 35 inches; brownish yellow (10YR 6/6) silty clay loam; common medium distinct yellowish brown (10YR 5/8) and light gray (10YR 7/1) mottles; weak coarse platy structure; very firm, brittle and compact; many pores; thin patchy clay films; very strongly acid; clear wavy boundary.

Bx2—35 to 50 inches; mottled light gray (10YR 7/1) and yellowish brown (10YR 5/8) silty clay loam; moderate coarse platy structure; firm, brittle and compact; 2 percent coarse fragments; strongly acid; gradual wavy boundary.

C—50 to 72 inches; mottled light gray (10YR 7/1), strong brown (7.5YR 5/6), and reddish yellow (7.5YR 6/8) silty clay loam; massive; firm; 10 percent shale fragments; very strongly acid.

R—72 inches; hard brown shale.

Depth to bedrock ranges from 40 to 90 inches. Reaction is strongly acid or very strongly acid except where lime has been added.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 5 or 6. It has mottles in shades of yellow or brown. This horizon is silt loam or silty clay loam.

The Bx horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 4 to 6, and has mottles in shades of gray or brown; or it is mottled in shades of gray, brown, or yellow. Texture is silt loam, loam, or silty clay loam.

The C horizon has colors similar to those of the Bx horizon. Texture is clay loam, silt loam, silty clay loam, silty clay, or their channery or very channery analogs. Some pedons have a B3 horizon that has the same colors and textures of the C horizon.

Cotaco Series

The Cotaco series consists of deep, somewhat poorly drained to moderately well drained soils that have moderate permeability. These soils formed in alluvium from acid sandstone, siltstone, and shale. These nearly level soils are on stream terraces. They are saturated early in winter and in spring because of a seasonal high water table at a depth of 0.5 foot to 1.5 feet. Most areas of these soils are subject to rare flooding late in winter and early in spring. Slope is dominantly less than 2 percent but ranges from 0 to 4 percent.

Cotaco soils are on the same landscape with Allegheny, Morehead, Shelocta, Stokly, and Stendal soils. Morehead soils, which are similar in setting, have a fine silty control section. Shelocta soils, which are on gently sloping colluvial fans, are well drained. Stokly and Stendal soils do not have an argillic horizon.

Typical pedon of Cotaco loam, rarely flooded; 1,000 feet southeast of Williamsburg City limits, 3,800 feet southwest of the confluence of Clear Fork and the Cumberland River, 2,000 feet east of the junction of U.S. Highway 92, 1,400 feet northeast of Savoy, and 100 feet west of a gravel road, in Whitley County.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) loam; moderate fine medium and coarse granular structure; friable; many roots; few rounded quartz pebbles; slightly acid; clear wavy boundary.

A2—6 to 10 inches; brown (10YR 5/3) fine sandy loam; moderate fine medium and coarse granular structure; friable; common roots; 2 to 5 percent coarse fragments, includes quartz pebbles; slightly acid; clear wavy boundary.

B1—10 to 17 inches; light yellowish brown (2.5Y 6/4) sandy clay loam; few medium distinct brownish yellow (10YR 6/6) mottles; weak medium and coarse subangular blocky structure; friable; small black concretions; 10 percent quartz pebbles; strongly acid; clear wavy boundary.

B2t—17 to 27 inches; light yellowish brown (2.5Y 6/4) sandy clay loam; common medium distinct light gray (10YR 7/1), brownish yellow (10YR 6/8), and strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; few thin patchy clay films; extremely acid; clear wavy boundary.

B3t—27 to 41 inches; light yellowish brown (10YR 6/4) loam; common medium distinct light gray (N 7/0), brownish yellow (10YR 6/6), and strong brown (7.5YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable; few thin patchy clay films; extremely acid; clear wavy boundary.

C1—41 to 55 inches; mottled light gray (N 7/0), pale yellow (2.5Y 7/4), brownish yellow (10YR 6/8), and yellowish red (5YR 4/6) loam; massive; extremely acid; gradual wavy boundary.

C2—55 to 70 inches; mottled light gray (10YR 7/1), brownish yellow (10YR 6/8), and pale yellow (2.5Y 7/4) loam; massive; extremely acid.

Depth to bedrock is more than 60 inches. Reaction ranges from strongly acid to extremely acid except where lime has been added.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B horizon has hue of 2.5Y to 10YR, value of 4 to 6, and chroma of 3 to 8. It is loam, sandy clay loam, or their gravelly analogs.

The C horizon is mottled in shades of gray, brown, yellow, or red. Texture is the same as the B horizon. In some pedons, the C horizon is stratified.

Cuba Series

The Cuba series consists of deep, well drained, moderately permeable soils that formed in acid, silty alluvium. These nearly level soils are on flood plains throughout the survey area. They are subject to frequent flooding of very brief duration during the winter and spring. Slope is dominantly less than 2 percent.

Cuba soils are on the same landscape with Pope, Stendal, Bonnie, Whitley, and Morehead soils. Pope soils, which are similar in setting, have a coarse-loamy control section. Stendal and Bonnie soils are not as well drained as Cuba soils. Whitley and Morehead soils have an argillic horizon.

Typical pedon of Cuba silt loam, frequently flooded; in a corn field, 3,400 feet north of Heidrick, on Kentucky Highway 11, 100 feet west of Little Richland Creek, in Knox County.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak fine and medium granular structure; friable; medium acid; abrupt smooth boundary.

B2—8 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; very strongly acid; clear smooth boundary.

C1—45 to 65 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and yellowish red (5YR 5/8) mottles; massive; friable; very strongly acid; clear smooth boundary.

C2—65 to 72 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silt loam; massive; friable; very strongly acid.

Depth to bedrock ranges from 60 to 120 inches or more. The reaction is very strongly acid or strongly acid throughout except in areas that have been treated with lime.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 8. In some pedons, the lower part of the C horizon has mottles in shades of brown or gray. Texture is commonly stratified silt loam, loam, or fine sandy loam and has layers of gravel in places.

DeKalb Series

The DeKalb series consists of moderately deep, well drained soils that have rapid permeability. They formed in residuum from sandstone. These steep to very steep soils are on narrow ridgetops and upper side slopes. Slopes range from 30 to 60 percent.

DeKalb soils are on the same landscape with Latham, Lily, and Steinsburg soils. Latham and Lily soils have an argillic horizon, and Steinsburg soils have less than 35 percent coarse fragments in the control section.

Typical pedon of DeKalb fine sandy loam, from an area of Latham-DeKalb complex, 30 to 60 percent slopes; 1.9 miles east of Gatliff, 2,000 feet from Kentucky Highway 904 on the Gatliff Fire Tower Road, in Whitley County.

O1—1 to 0 inch; hardwood leaf litter mainly from oaks.
A1—0 to 1 inch; very dark gray (10YR 3/1) fine sandy loam; weak fine granular structure; loose to very friable; extremely acid; clear smooth boundary.
A2—1 to 6 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak fine granular structure; 5 percent coarse fragments; extremely acid; clear smooth boundary.
B1—6 to 14 inches; brownish yellow (10YR 6/6) channery fine sandy loam; weak fine medium and coarse subangular blocky structure; very friable; 35 percent coarse fragments; extremely acid; clear smooth boundary.
B2—14 to 20 inches; brownish yellow (10YR 6/6) very channery fine sandy loam; moderate medium and coarse subangular blocky structure; very friable; few thin patchy clay films; 40 percent coarse fragments; extremely acid; clear smooth boundary.
C—20 to 31 inches; brownish yellow (10YR 6/6) very channery fine sandy loam; massive; friable; 55 percent coarse fragments; very strongly acid; clear smooth boundary.
R—31 inches; fractured yellowish brown sandstone.

Depth to bedrock ranges from 20 to 40 inches. Reaction ranges from extremely acid to strongly acid except where lime has been added. Coarse fragments of sandstone range from 35 to 75 percent in the solum and from 50 to 90 percent in the C horizon.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. Texture is fine sandy loam or their channery, very channery, or extremely channery analogs.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 6 to 8. Texture is channery or flaggy fine sandy loam or sandy loam.

Fairpoint Series

The Fairpoint series consists of deep, well drained soils that have moderately slow permeability. They formed in medium acid to neutral regolith from surface mine operations. These nearly level to very steep soils are on ridgetops, benches, side slopes, terraces, and flood plains. Slopes range from 0 to 70 percent.

Fairpoint soils are on the same landscape with Bethesda, Latham, Shelocta, Wernock, DeKalb, Stendal, Bonnie, and Morehead soils. Bethesda soils, which are intermingled with Fairpoint soils, are acid. Latham soils, which are on ridgetops and upper side slopes, have a clayey control section. Shelocta soils, which are on lower side slopes, have an argillic horizon and solum thickness of 40 to 60 inches. Wernock soils, which are on upland ridgetops, are moderately deep and have a fine-silty control section. Stendal and Bonnie are somewhat poorly drained and poorly drained bottom soils. Morehead soils, which are on terraces, have an argillic horizon and are somewhat poorly drained to moderately well drained.

Typical pedon of Fairpoint gravelly silt loam, from an area of Fairpoint and Bethesda soils, 20 to 70 percent slopes; 800 feet northeast of Pentecostal Children's Home, 2.5 miles northeast of Barbourville, in Knox County.

Ap—0 to 12 inches; brown (10YR 5/3) gravelly silt loam; moderate fine and medium subangular blocky structure; friable; many very fine and fine roots; 35 percent randomly oriented coarse fragments 0.5 to 5.0 cm in diameter, 10 cm layer of soft rippable silty shale at about 25 cm; neutral; clear smooth boundary.
C1—12 to 32 inches; yellowish brown (10YR 5/4) very gravelly loam; weak fine and medium subangular blocky structure; firm; few fine roots; 36 percent randomly oriented 1 to 6 cm coarse fragments; medium acid; gradual smooth boundary.
C2—32 to 60 inches; brown (10YR 5/3) very gravelly silt loam; weak medium subangular blocky structure; firm; few fine roots; 40 percent randomly oriented 1 to 10 cm coarse fragments; neutral.

Depth to bedrock is more than 60 inches. Reaction ranges from medium acid to neutral except where lime has been added. Coarse fragments include shale, siltstone, sandstone, and coal. The fragments range

from 20 to 80 percent in individual horizons, but they average about 45 percent.

The A horizon has hue of 10YR to 2.5Y, value of 3 to 6, and chroma of 1 to 8; or it is neutral (N) and has value of 3 to 6. It is gravelly or shaly silt loam, shaly clay loam, loam, or silty clay loam.

The C horizon has hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 1 to 6; or it is neutral (N) and has value of 3 to 6. It is gravelly, very gravelly, shaly, very shaly, channery, or very channery clay loam, silty clay loam, silt loam, or loam.

Huntington Series

The Huntington series consists of deep, well drained, moderately permeable soils that formed in alluvium washed from sandstone, shale, siltstone, and limestone. These nearly level soils are on flood plains along the Cumberland River throughout the survey area and along the Clear Fork in Whitley County. They are subject to occasional flooding of brief duration during the winter and spring.

Huntington soils are on the same landscape with Newark, Bonnie, Morehead, Whitley, and Allegheny soils. They are better drained than the Newark, Bonnie, and Morehead soils and do not have the argillic horizon of the Whitley and Allegheny soils.

Typical pedon of Huntington silt loam, occasionally flooded; 100 feet north of the old bridge on Cumberland River on west side of the old railroad grade and 1,400 feet south of Artemus, in Knox County.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam; brown (10YR 5/3) dry; weak fine and medium granular structure; friable; neutral; clear smooth boundary.

B1—10 to 34 inches; dark grayish brown (10YR 4/2) silt loam; very dark grayish brown (10YR 3/2) ped faces; weak fine and medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

B2—34 to 44 inches; dark brown (10YR 4/3) silt loam; dark grayish brown (10YR 4/2) ped faces; weak medium and coarse subangular blocky structure; friable; medium acid; clear smooth boundary.

C—44 to 62 inches; dark brown (10YR 4/3) loam; massive; 2 percent coarse fragments; medium acid.

The solum is more than 40 inches thick, and the mollic epipedon ranges from 10 to 24 inches thick. Reaction ranges from medium acid to mildy alkaline in unlimed areas.

The A1 or Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 2 or 3.

The B horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. Texture is silt loam or silty clay loam.

The C horizon is similar in hue, value, and chroma to the B horizon. It consists of stratified silt loam, loam, silty clay loam, and fine sandy loam. The C horizon commonly contains more sand than the B horizon.

Latham Series

The Latham series consists of moderately deep, moderately well drained soils that have slow permeability. They formed in residuum from acid shale. These sloping to very steep soils are on narrow ridgetops and side slopes. Slope is dominantly more than 20 percent but ranges from 6 to 60 percent.

Latham soils are on the same landscape with Shelocta, DeKalb, Wernock, and Lily soils. Shelocta soils, which are on linear and concave side slopes, have a fine-loamy control section and a thicker solum than Latham soils. DeKalb soils have a loamy-skeletal control section, are formed in sandstone residuum, and do not have an argillic horizon. Wernock soils, which are on broader and more gently sloping ridgetops, have a fine-silty control section. Lily soils, which also are on broader and more gently sloping ridgetops, have a fine-loamy, siliceous control section.

Typical pedon of Latham silt loam, 12 to 20 percent slopes; 6.5 miles northwest of Barbourville on U.S. Highway 25E; 350 feet north of the highway; 2,600 feet northwest of confluence of Booger Hollow and Middle Fork, in Knox County.

O1—1/2 to 0 inch; partly decomposed leaf litter.

A1—0 to 1 inch; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; very friable; many fine roots; few shale fragments; very strongly acid; abrupt smooth boundary.

B1—1 to 6 inches; yellowish brown (10YR 5/6) silty clay loam; weak fine and medium subangular blocky structure; friable; many fine roots; common fine pores; few shale fragments less than 1 inch across; extremely acid; clear smooth boundary.

B21t—6 to 13 inches; strong brown (7.5YR 5/6) silty clay; moderately coarse subangular blocky structure parting to moderately fine angular blocky; firm; few fine roots; few fine pores; nearly continuous clay films; few shale fragments less than 1 inch across; extremely acid; gradual smooth boundary.

B22t—13 to 20 inches; strong brown (7.5YR 5/6) silty clay; common fine distinct light gray (10YR 7/2) and brownish yellow (10YR 6/6) mottles; moderate coarse subangular blocky structure parting to moderately fine angular blocky; firm; few fine roots; few fine pores; nearly continuous clay films; very strongly acid; clear smooth boundary.

B3—20 to 24 inches; mottled red (2.5YR 4/6), light gray (10YR 7/2), and brown (7.5YR 5/4) silty clay loam; weak thin platy structure; firm; few fine roots; few

fine pores; very strongly acid; gradual smooth boundary.
Cr—24 to 35 inches; brown (7.5YR 4/4) clayey shale; light gray coatings on most structure planes, few dark red coatings; two harder black shale strata 0.5 inch thick; very strongly acid.

Depth to paralithic contact ranges from 20 to 40 inches. Reaction ranges from strongly acid to extremely acid except where lime has been added. Coarse fragments of soft shale, siltstone, or sandstone range from 0 to 15 percent in the solum and from 0 to 30 percent in the C horizon.

The A or Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 6.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 8. Some pedons have a subhorizon that has hue of 5YR and 2.5Y. Mottles are in shades of red, brown, yellow, or gray. Texture is silty clay loam, silty clay, or clay.

Lily Series

The Lily series consists of moderately deep, well drained soils that have moderately rapid permeability. These soils formed in acid sandstone residuum. These sloping to steep soils are on narrow convex ridgetops. Slope ranges from 6 to 30 percent.

Lily soils are on the same landscape with Latham, Steinsburg, and Wernock soils. Latham soils have more clay in the B horizon and are generally underlain by soft shale. Steinsburg soils do not have an argillic horizon. Wernock soils have a fine-silty control section.

Typical pedon of Lily loam, 6 to 12 percent slopes; 1.2 miles east of Corbin, on a ridgetop 75 feet south of U.S. Highway 25E and 1/3 mile east of Marvel Road, in Knox County.

Ap—0 to 6 inches; dark brown (10YR 4/3) loam; weak fine granular structure; friable; many fine roots; neutral; gradual wavy boundary.
B21t—6 to 17 inches; brownish yellow (10YR 6/6) sandy clay loam; weak to moderate fine and medium subangular blocky structure; friable; common fine roots; common thin clay films; 2 percent coarse fragments; strongly acid; gradual smooth boundary.
B22t—17 to 26 inches; yellowish brown (10YR 5/8) clay loam; moderate fine and medium subangular blocky structure; friable; few fine roots; many thin clay films; common mica flakes; 5 to 10 percent coarse fragments; very strongly acid; gradual wavy boundary.
R—26 inches; strong brown (7.5YR 5/8) sandstone containing mica flakes.

Depth to bedrock ranges from 20 to 40 inches. Reaction ranges from strongly acid to extremely acid except where lime has been added. Coarse fragments range from 0 to 10 percent in the A and upper part of the B horizon and 0 to 30 percent in the lower part of the B horizon.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 4 to 8. Texture is fine sandy loam, loam, sandy clay loam, or clay loam.

The sandstone bedrock is in shades of brown, red, yellow, and gray.

Morehead Series

The Morehead series consists of deep, somewhat poorly drained to moderately well drained soils that have moderate permeability. These soils formed in silty acid alluvium washed from silty upland soils that weathered from sandstone, siltstone, and shale. These nearly level soils are on stream terraces and alluvial fans, and most areas are subject to rare flooding late in winter or early in spring. The soils are saturated late in winter or in spring because of a seasonal high water table at a depth of 0.5 foot to 1.5 feet. Slopes range from 0 to 4 percent.

Morehead soils are on the same landscape with Cotaco, Allegheny, Stendal, and Whitley soils. Cotaco soils, which are similar in setting, have a fine-loamy control section. Whitley and Allegheny soils are well drained. Stendal soils do not have an argillic horizon.

Typical pedon of Morehead silt loam, rarely flooded; in a fescue field, 350 feet east of U.S. Highway 25E, 6.7 miles east of Barbourville, and 800 feet northwest of the junction of Kentucky Highway 223 and U.S. Highway 25E, in Knox County.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; moderate medium subangular blocky structure parting to weak fine granular; very friable; many fine roots; common fine pores; medium acid; abrupt smooth boundary.
B1—6 to 12 inches; yellowish brown (10YR 5/6) silt loam; common fine faint light yellowish brown and strong brown mottles; weak medium subangular blocky structure; very friable; common fine roots; common fine pores; medium acid; gradual smooth boundary.
B21t—12 to 19 inches; light yellowish brown (10YR 6/4) silt loam; common medium faint strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; friable; common fine roots; common fine pores; common discontinuous pale brown clay films on prisms and strong brown discontinuous clay films on blocks; very strongly acid; clear smooth boundary.
B22t—19 to 49 inches; mottled strong brown (7.5YR 5/6), light yellowish brown (10YR 6/4), and light brownish gray (10YR 6/2) silt loam; weak coarse prismatic structure parting to weak medium

subangular blocky; friable; few fine roots; common fine pores; discontinuous light brownish gray clay films on prisms and few strong brown clay films on blocks; few dark brown concretions and black stones; strongly acid; gradual smooth boundary.

C—49 to 67 inches; mottled light gray (10YR 7/2) and light yellowish brown (10YR 6/4) loam; massive; firm; few fine roots; few fine pores; 25 percent soft black concretions 0.25 inch to 3 inches in diameter; very strongly acid.

Depth to bedrock is 60 to 120 inches or more. Reaction is strongly acid or very strongly acid except where lime has been added.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The Bt horizon has hue of 10YR, 7.5YR, or 2.5Y, value of 5 or 6, and chroma of 4 to 6. Mottles are in shades of brown or gray. It is silt loam or silty clay loam.

The C horizon is mottled in hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 6. Texture is silt loam, loam, or silty clay loam.

The Morehead soils in the survey area are taxadjuncts to the Morehead series. They have a higher content of sand coarser than very fine than is allowed for the series.

Newark Series

The Newark series consists of deep, somewhat poorly drained, moderately permeable soils that formed in mixed alluvium from soils derived from limestone, sandstone, siltstone, and shale. These nearly level soils are on flood plains. They are subject to occasional flooding of brief duration during the winter and spring. They are saturated in the winter and in spring and have a seasonal high water table at a depth of 0.5 foot to 1.5 feet. Slope is dominantly less than 2 percent.

Newark soils are on the same landscape with Huntington, Bonnie, and Whitley soils. Huntington soils, which are similar in setting, are well drained. Bonnie soils are less well drained than Newark soils. Whitley soils are well drained and have an argillic horizon.

Typical pedon of Newark silt loam, occasionally flooded; 600 feet southeast of the confluence of Brush Creek and Owens Branch, 100 feet south of Owens Branch, 700 feet northwest of Kentucky Highway 225, 1 mile south of Artemus, and 2,800 feet south of Cumberland River Bridge, in Knox County.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam; common medium faint gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; weak fine granular structure; friable; neutral; abrupt smooth boundary.

B1—9 to 18 inches; brown (10YR 5/3) silt loam; common medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.

B2g—18 to 40 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

C1g—40 to 66 inches; grayish brown (2.5Y 5/2) silt loam; many coarse distinct yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) mottles; massive; friable; black manganese and iron concretions; slightly acid; gradual smooth boundary.

C2g—66 to 85 inches; gray (N 6/0) silt loam; common medium distinct brownish yellow (10YR 6/8) mottles; massive; neutral.

The solum ranges in thickness from 22 to 44 inches. Depth to bedrock ranges from 60 to 240 inches or more. Coarse fragments range from none to about 5 percent, by volume, to a depth of about 30 inches and from none to about 15 percent below a depth of 30 inches. Reaction ranges from medium acid to mildly alkaline throughout.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4.

The B1 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. Mottles are in shades of gray or brown. Texture is silt loam or silty clay loam.

The B2g horizon has hue of 10YR to 2.5Y, value of 4 to 7, and chroma of 1 or 2. Mottles are in shades of brown or gray. Texture is silt loam or silty clay loam.

The Cg horizon is grayish brown or gray and has mottles in shades of brown, red, and yellow. Texture is silt loam or silty clay loam. The Cg horizon has thin layers of loam or fine sandy loam in some pedons.

Pope Series

The Pope series consists of deep, well drained soils that have moderately rapid permeability. These soils formed in recent alluvium from soils weathered from acid sandstone, siltstone, and shale. These nearly level soils are on narrow flood plains primarily in the northeastern part of Knox County and are subject to frequent flooding of brief or very brief duration during the winter and spring. Slope is dominantly less than 2 percent.

Pope soils are on the same landscape with Stokly, Stendal, and Cuba soils. Pope soils are better drained than the Stokly and Stendal soils and contain more sand and coarse fragments than the Cuba soils.

Typical pedon of Pope gravelly fine sandy loam, frequently flooded; 200 feet east of confluence of Alex Creek and Pigeon Fork, 50 feet north of the creek, 300 feet southeast of the former Taylor School building, near Erose in Knox County.

Ap—0 to 8 inches; brown (10YR 4/3) gravelly fine sandy loam; weak fine and medium granular structure; very friable; many fine roots; 15 percent sandstone gravel; strongly acid; clear smooth boundary.
B21—8 to 20 inches; brown (7.5YR 4/4) gravelly fine sandy loam; weak medium subangular blocky structure; very friable; common roots; 15 percent gravel; few fine pores; very strongly acid; clear smooth boundary.
B22—20 to 32 inches; dark yellowish brown (10YR 4/6) gravelly fine sandy loam; weak fine and medium subangular blocky structure; very friable; common roots; 25 percent gravel; few fine pores; very strongly acid; clear smooth boundary.
C—32 to 60 inches; dark yellowish brown (10YR 4/6) very channery loamy sand; single grained; loose; 55 percent coarse fragments; very strongly acid.

Depth to bedrock is 5 feet or more. The solum ranges in thickness from 30 to 50 inches. Reaction is strongly acid or very strongly acid except where lime has been added. The A and B horizons have 0 to 55 percent gravel.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 6. It is fine sandy loam or loam and their gravelly analogs.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. It is stratified layers of loamy sand, sandy loam, fine sandy loam, loam, and their channery or gravelly analogs.

Rigley Series

The Rigley series consists of deep, well drained soils that have moderately rapid permeability. These soils formed in colluvium from acid sandstone, siltstone, and a minor component of shale. These steep and very steep soils are on side slopes in deep ravines on the south side of Pine Mountain. Slopes range from 30 to 60 percent.

Rigley soils are on the same landscape with Shelocta, Steinsburg, and Lily soils. Shelocta and Lily soils have a fine-loamy control section, and Lily soils have sola less than 40 inches thick. Steinsburg soils are less than 40 inches to bedrock and do not have an argillic horizon.

Typical pedon of Rigley fine sandy loam, from an area of Rigley-Shelocta-Rock outcrop complex, 30 to 60 percent slopes; in a wooded area, 4,200 feet northwest of the junction of county lines of Whitley County, Kentucky, and Claiborne and Campbell Counties, Tennessee, 2,200 feet north of Tennessee state line, on tributary of Primroy Creek, 3.6 miles east of Lot, in Whitley County.

O1—1 to 0 inch; partly decomposed leaf litter.
A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak medium granular structure; very friable; many fine roots; 5 percent coarse fragments; extremely acid; clear smooth boundary.
B1—4 to 10 inches; brown (10YR 4/3) fine sandy loam; weak medium granular structure; very friable; many fine roots; 10 percent coarse fragments; extremely acid; gradual wavy boundary.
B21t—10 to 25 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; common roots; common thin clay films; 10 percent coarse fragments; extremely acid; gradual smooth boundary.
B22t—25 to 38 inches; brown (7.5YR 4/4) channery loam; moderate medium subangular blocky structure; friable; common roots; common thin clay films; 25 percent coarse fragments; extremely acid; gradual smooth boundary.
B23t—38 to 45 inches; yellowish brown (10YR 5/4) channery loam; weak medium subangular blocky structure; friable; common roots; common thin clay films; 35 percent coarse fragments; extremely acid; gradual wavy boundary.
C—45 to 62 inches; yellowish brown (10YR 5/4) very channery sandy clay loam; few fine faint pale brown mottles; massive; friable; 60 percent coarse fragments; extremely acid.

Depth to bedrock ranges from 60 to 100 inches or more. Reaction ranges from strongly acid to extremely acid. Coarse fragments of sandstone and shale range from 5 to 35 percent in the solum and from 20 to 70 percent in the C horizon.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4.

The B1 horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Texture is fine sandy loam, sandy loam, loam, or their channery or gravelly analogs.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. Texture is sandy loam or loam, or their channery or gravelly analogs.

The C horizon has the same color as those of the B horizon. In some pedons, it has mottles in shades of brown or yellow. Texture is sandy loam, loam, sandy clay loam, or their gravelly, channery, or cobbly analogs.

Shelocta Series

The Shelocta series consists of deep, well drained soils that have moderate permeability. These soils formed in colluvium from acid shale, siltstone, and sandstone. These gently sloping to very steep soils are on side slopes, benches, coves, foot slopes, and alluvial fans. Slope is dominantly 20 to 40 percent but ranges from 2 to 85 percent.

Shelocta soils are on the same landscape as those of Rigley and Bledsoe soils are are near Latham and

Steinsburg soils on narrow ridgetops and convex slopes. Latham soils have a clayey control section. Bledsoe soils have a fine control section, and the Rigley and Steinsburg soils have a coarse loamy-control section.

Typical pedon of Shelocta silt loam, from an area of Shelocta-Latham silt loams, 30 to 60 percent slopes; in a wooded area, 12 miles east of Barbourville on the Mill Branch of Road Fork Creek; 0.4 mile east of the junction of Mill Branch Road and Meadow Branch Road; in Knox County.

A1—0 to 6 inches; dark brown (10YR 4/3) silt loam; weak medium granular structure; friable; common fine and medium roots; common fine pores; 10 percent sandstone channers; very strongly acid; clear smooth boundary.
B1—6 to 14 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; common fine roots; common fine pores; 10 percent sandstone channers; very strongly acid; gradual smooth boundary.
B21t—14 to 29 inches; strong brown (7.5YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common fine pores; few distinct thin patchy clay films on faces of peds and in root channels; 20 percent sandstone and siltstone channers; very strongly acid; gradual smooth boundary.
B22t—29 to 48 inches; strong brown (7.5YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; firm; few fine pores; common continuous clay films on faces of peds and fragments; 20 percent sandstone channers; very strongly acid; gradual smooth boundary.
B3t—48 to 58 inches; yellowish brown (10YR 5/4) very channery silty clay loam; few fine and medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; few distinct patchy strong brown (7.5YR 5/6) clay films on faces of peds; 40 percent sandstone channers; few black stains and soft concretions; very strongly acid; gradual smooth boundary.
C—58 to 74 inches; yellowish brown (10YR 5/4) very channery silt loam; many fine and medium distinct pale brown (10YR 6/3) and strong brown (7.5YR 5/6) mottles; massive; very firm; few black stains; 45 percent sandstone channers and shale fragments; very strongly acid.

Depth to bedrock ranges from 48 to more than 120 inches. Reaction is strongly acid or very strongly acid except where lime has been added. Coarse fragments of shale, siltstone, and sandstone range from 5 to 35 percent in the solum and from 15 to 70 percent in the C horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. Texture is silt loam, loam, or their gravelly or channery analogs.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. In some pedons, this horizon has mottles in shades of brown in the upper part and in shades of gray in the lower part. Texture is silt loam, silty clay loam, or their channery or gravelly analogs.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 4 to 6. In some pedons, this horizon has mottles in shades of brown, olive, or gray. Texture is silt loam, silty clay loam, clay loam, loam, or their gravelly or channery analogs.

The Shelocta soils in the survey area are taxadjuncts to the Shelocta series. They have a higher sand content than is allowed for the series, and the mineralogy is siliceous.

Steinsburg Series

The Steinsburg series consists of moderately deep, well drained soils that have moderately rapid permeability. These soils formed in acid sandstone residuum. These moderately steep to very steep soils are on long, convex ridgetops and upper side slopes. Slopes range from 12 to 80 percent.

Steinsburg soils are on the same landscape with Lily, Latham, Wernock, and DeKalb soils. Lily, Latham, and Wernock soils have an argillic horizon. DeKalb soils have more than 35 percent coarse fragments in the control section.

Typical pedon of Steinsburg fine sandy loam, from an area of Lily-Steinsburg fine sandy loams, 12 to 30 percent slopes; on a ridgetop near the head of Primroy Creek, 4,200 feet northwest of the junction of Whitley County, Kentucky, and Claiborne and Campbell Counties, Tennessee; 2,400 feet south of the top of Pine Mountain; 5,600 feet east of Gravely Gap; 3.8 miles east of Lot, in Whitley County.

O1—1 to 0 inch; partly decomposed organic matter.
A—0 to 6 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine granular structure; friable; extremely acid; abrupt smooth boundary.
B—6 to 20 inches; yellowish brown (10YR 5/6) fine sandy loam; weak fine subangular blocky structure; friable; 10 percent coarse fragments; extremely acid; clear smooth boundary.
C—20 to 29 inches; yellowish brown (10YR 5/6) gravelly fine sandy loam; massive; very firm; 35 percent coarse fragments; extremely acid; gradual wavy boundary.
Cr—29 to 34 inches; soft sandstone.

Depth to bedrock ranges from 24 to 40 inches. Reaction ranges from strongly acid to extremely acid except where lime has been added. Coarse fragments range from 5 to 35 percent in the B horizon and up to 60 percent in the C horizon, but the control section is less than 35 percent coarse fragments.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. Texture is fine sandy loam.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. Texture is fine sandy loam or sandy loam and their gravelly or channery analogs.

The C horizon has similar hue, chroma, and value as that of the B horizon. Texture is fine sandy loam, sandy loam, or loamy sand and their gravelly or channery analogs.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained, moderately permeable soils that formed in silty alluvium from soils derived from sandstone, siltstone, and shale. These nearly level soils are on flood plains. They are subject to frequent flooding of very brief duration during the winter and spring. They are saturated in winter and spring and have a seasonal high water table at a depth of 1 foot to 2 feet. Slope is dominantly less than 2 percent.

Stendal soils are on the same landscape with Bonnie, Stokly, Cuba, Cotaco, and Morehead soils. They are not as well drained as Cuba soils, contain less sand than the Cotaco and Stokly soils, do not have the argillic horizon of Morehead and Cotaco soils, which are on slightly higher elevations, and are better drained than the poorly drained Bonnie soils.

Typical pedon of Stendal silt loam, frequently flooded; 500 feet south of Jarvis Grocery, 0.5 mile south of the intersection of Kentucky Highway 229 and Kentucky Highway 1803, in Knox County.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; common medium faint dark yellowish brown (10YR 4/4) mottles; weak fine granular structure; friable; many fine roots; few mica flakes; medium acid; abrupt smooth boundary.

C1—8 to 16 inches; brown (10YR 5/3) silt loam; few medium faint dark yellowish brown (10YR 4/4) mottles; weak fine granular structure; friable; common fine roots; few small mica flakes; strongly acid; gradual smooth boundary.

C2g—16 to 22 inches; grayish brown (10YR 5/2) silt loam; many medium and fine faint olive (5Y 5/3) mottles; weak medium fine granular structure; friable; common fine roots; few small mica flakes; strongly acid; gradual smooth boundary.

C3g—22 to 35 inches; grayish brown (2.5Y 5/2) silt loam; common medium faint light olive brown (2.5Y 5/4) mottles; weak medium granular structure; friable; few medium and fine roots; common dark brown (10YR 3/3) stains; few fine mica flakes; strongly acid; gradual smooth boundary.

C4g—35 to 48 inches; olive gray (5Y 5/2) silt loam; many coarse distinct light olive brown (2.5Y 5/4) mottles; massive; friable; few medium and fine roots; common gray (5Y 6/1) stains in root channels and cracks; few small mica flakes; medium acid; gradual smooth boundary.

C5g—48 to 60 inches; gray (10YR 5/1) silty clay loam; many coarse prominent yellowish brown (10YR 5/6) mottles and few fine distinct light olive brown (2.5Y 5/4) mottles; massive; firm; few small mica flakes; strongly acid.

Depth to bedrock is 60 inches or more. Reaction is strongly acid or very strongly acid except where lime has been added.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 3, and has mottles that have hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 1 to 6. Texture is silt loam or silty clay loam. In places, this horizon has thin strata of loam or fine sandy loam.

Stokly Series

The Stokly series consists of deep, somewhat poorly drained soils that have moderately rapid permeability. These soils formed in alluvium from acid sandstone, siltstone, and shale. These nearly level soils are on flood plains on small streams. They are subject to frequent flooding of very brief duration during the winter and spring and have a seasonal high water table at a depth of 0.5 to 1.0 foot. Slope is dominantly less than 2 percent.

Stokly soils are on the same landscape with Pope, Stendal, Bonnie, and Cotaco soils. Pope soils, which are on adjacent flood plains, are well drained. Stendal soils have a fine-silty control section. Stokly soils do not have the argillic horizon of the Cotaco soils and are better drained than the Bonnie soils.

Typical pedon of Stokly fine sandy loam, frequently flooded; 200 feet west of Fighting Creek; 1.4 miles south of Hinkle, in Knox County.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) fine sandy loam; few medium distinct grayish brown (2.5Y 5/2) and yellowish red (5YR 4/6) mottles; weak fine and medium granular structure; very friable; many fine roots; slightly acid; clear smooth boundary.

B21—8 to 20 inches; pale brown (10YR 6/3) fine sandy loam; few medium distinct yellowish red (5YR 4/6) mottles; weak fine and medium subangular blocky structure; friable; many fine roots; medium acid; clear smooth boundary.

B22g—20 to 35 inches; light brownish gray (2.5Y 6/2) fine sandy loam; common fine and medium grayish brown (10YR 5/2) and yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable; many fine roots; medium acid; clear wavy boundary.

C—35 to 60 inches; mottled strong brown (7.5YR 5/6) and gray (10YR 6/1) loamy sand; massive; very friable; strongly acid;

Depth to bedrock is 60 inches or more. The solum ranges in thickness from 20 to 40 inches. Reaction is strongly acid to extremely acid throughout except where lime has been added. Sandstone and siltstone pebbles and fragments range from 0 to 15 percent in the solum and 0 to 40 percent in the C horizon.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. In most pedons, it is mottled in shades of brown, gray, or red.

The B2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. Mottles are in shades of brown, gray, or red. Texture is fine sandy loam or loam.

The B2g horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2; or it is neutral and has value of 5 or 6. Mottles are in shades of brown or gray. Texture is loamy sand, fine sandy loam, or sandy loam or their gravelly or channery analogs.

The C horizon is mottled in shades of brown or gray. Texture is similar to that of the B2g horizon.

Wernock Series

The Wernock series consists of moderately deep, well drained, moderately permeable soils that formed in residuum from acid sandstone, siltstone, and shale. These gently sloping to moderately steep soils are on upland ridgetops. Slopes range from 2 to 20 percent.

Wernock soils are on the same landscape with Latham, Clarkrange, and Lily soils. Latham soils, which are similar in setting to the Wernock soils, have a clayey control section. Clarkrange soils, which are on broad upland ridgetops, have a fragipan and are moderately well drained. Lily soils have a fine-loamy control section.

Typical pedon of Wernock silt loam, 2 to 6 percent slopes; in a woods, 4,000 feet northeast of Lynn Camp Church, 1.8 miles east of North Corbin, 3,800 feet north of the junction of Watch Road and U.S. Highway 25E, 1,750 feet northwest of Watch, in Knox County.

O1—1 to 0 inch; partly decomposed hardwood leaf litter.
A1—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; very friable; many fine, medium, and coarse roots; strongly acid; abrupt smooth boundary.
A2—2 to 5 inches; yellowish brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; very strongly acid; clear smooth boundary.
B21t—5 to 12 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; few fine pores; few thin patchy clay films on faces of peds and in root channels; very strongly acid; gradual smooth boundary.
B22t—12 to 29 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine pores; common clay films on faces of peds; very strongly acid; gradual smooth boundary.
B3t—29 to 34 inches; yellowish brown (10YR 5/6) silty clay loam; few fine faint strong brown mottles and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure parting to fine angular blocky; firm; few fine roots; 5 percent fine sandstone fragments; very strongly acid; clear smooth boundary.
C—34 to 38 inches; yellowish brown (10YR 5/6) silt loam; common fine and medium faint strong brown (7.5YR 5/6) mottles and common fine distinct light gray (10YR 7/2) mottles; massive; firm; 15 percent sandstone fragments; very strongly acid; abrupt irregular boundary.
Cr—38 to 42 inches; soft brownish and reddish fine sandstone.

Depth to bedrock ranges from 30 to 40 inches. Reaction ranges from strongly acid to extremely acid throughout except in areas that have been treated with lime. Coarse fragments range from 0 to 10 percent, by volume, to a depth of about 24 inches; below 24 inches, coarse fragments range from 0 to more than 50 percent.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 or Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. In some pedons, it has mottles in shades of brown or red. In some pedons below a depth of 24 inches the mottles are in shades of gray. Texture is silt loam or silty clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. Texture is silt loam or silty clay loam and the gravelly, shaly, or channery analogs.

Whitley Series

The Whitley series consists of deep, well drained, moderately permeable soils formed in mixed alluvium from acid siltstone, sandstone, and shale. These nearly level to sloping soils are on stream terraces of major streams and their tributaries throughout the survey area. Most areas of these soils are subject to rare flooding late in winter and early in spring. Slopes range from 0 to 12 percent.

Whitley soils are on similar landscapes to those of the Huntington, Cuba, Newark, Stendal, Bonnie, Morehead, Cotaco, and Allegheny soils. Huntington and Cuba soils do not have an argillic horizon. Newark, Stendal, and Bonnie soils are less well drained than Whitley soils. Allegheny soils have a fine-loamy control section.

Typical pedon of Whitley silt loam, 2 to 6 percent slopes, rarely flooded; in a corn field, 100 feet south of

Kentucky Highway 511, 600 feet west of Imperial Hollow, 1.4 miles east of the junction of Kentucky Highway 216 and Kentucky Highway 511, 1.4 miles east of Rockholds, in Whitley County.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

B21t—8 to 18 inches; brownish yellow (10YR 6/8) silty clay loam; moderate medium and fine subangular blocky structure; firm; few fine roots; few thin clay films on faces of peds, in pores and root channels; strongly acid; gradual smooth boundary.

B22t—18 to 34 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular block structure; firm; few fine roots; common thin clay films on faces of peds, in pores and root channels; very strongly acid; gradual smooth boundary.

B3—34 to 52 inches; brownish yellow (10YR 6/8) silt loam; common medium distinct very pale brown (10YR 7/3) mottles; weak fine and medium subangular blocky structure; friable; no roots; very strongly acid; clear smooth boundary.

C—52 to 72 inches; mottled brownish yellow (10YR 6/8), light yellowish brown (10YR 6/4), and light gray (10YR 7/2) silt loam; massive; friable; common small black concretions; very strongly acid.

Depth to bedrock ranges from 60 to 120 inches or more. Reaction is strongly acid or very strongly acid throughout except where lime has been added.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 8. The lower part of the B horizon has mottles in shades of brown. Texture is silt loam or silty clay loam in the upper part and silt loam, silty clay loam, loam, or clay in the lower part.

The C horizon is mottled in shades of brown, yellow, and gray. Texture is similar to the lower part of the B horizon.

Formation of the Soils

The characteristics of a soil are determined by climate, plant and animal life, parent material, topography, and time. Soils are formed through the interaction of these factors, but the relative importance of each factor is not constant from one soil to another. The effects of climate and plant and animal life are not likely to vary much within the survey area, but local differences in relief and parent material can affect the characteristics of a soil considerably. The interrelationship among the five factors of soil formation is complex, and the effect of any one factor is difficult to isolate. Other factors, such as gravity and man, are also important in the formation of soils.

Factors of Soil Formation

In this section, the factors of soil formation are described as they relate to the soils of the survey area.

Climate

Climate affects the chemical, physical, and biological properties of a soil. The principal components of climate are precipitation and temperature. Precipitation and temperature influence vegetation, and vegetation affects formation of soil. Climate affects the animals and micro-organisms that live in soil, influences weathering of rocks and minerals, and affects removal and deposition of material by water. The speed of chemical processes is also directly related to temperature and, in most cases, to water.

The climate of the survey area, which is temperate and humid, has probably remained relatively constant for a very long time. Winters are fairly mild, and the temperature is extremely low only for short periods. The average temperature in January is 35.7 degrees F. Periods of high temperature in summer are generally fairly short. The average temperature in July is 75.6 degrees F. The normal annual precipitation, which is 50.6 inches, is fairly well distributed throughout the year.

The soils in the survey area are moist and unfrozen most of the time and are subject to almost continuous leaching. Under these conditions, soluble bases and clay minerals are carried from the surface layer into the subsoil by water percolating through the profile. This tends to produce acid soils, provided the bases leach or percolate completely through the soil. Also, clay minerals tend to accumulate in the subsoil. As a result, most of the soils in the survey area have a leached, acid surface layer and a subsoil that has a finer texture than the surface layer. Allegheny and Wernock soils are examples.

A sloping soil is affected slightly, but significantly, by the direction of slope. Steep Shelocta soils, for example, have a darker color surface layer on north-facing slopes than on south-facing slopes. This is because soils on north-facing slopes are cooler and more moist, so more organic matter accumulates in the surface layer. A study in McCreary County, Kentucky, to the west of the survey area, found that 20 inches below the surface a north-facing slope was nearly 3 degrees cooler than a nearby south-facing slope *(12)*.

Plant and Animal Life

Plants and animals, but mainly plants, are considered active soil-forming factors. They add organic matter to the soil and aid in soil formation and development. Plants bring nutrients from the lower part of the soil to the upper layers, produce channels through which air and water circulate, and improve soil structure. Animals and micro-organisms mix and decompose the organic matter, making plant nutrients available and generally improving the condition of the soil.

The native vegetation of the area was predominantly deciduous trees. Virginia and shortleaf pines were common on narrow, droughty ridges. The kinds of plants growing affect the kinds of soils formed. For example, the litter from pines decomposes to produce more organic acids than litter from hardwoods. Soils that developed under pines tend to be more highly leached than those that developed under hardwoods. For examples, DeKalb soils developed mostly under pines, and they have low natural fertility and low organic-matter content. On the other hand, Shelocta soils developed mostly under hardwoods and have medium fertility and organic matter content.

Forest litter reduces frost penetration and retards drying. The soils under trees, however, tend to be dryer than adjacent soils in open fields, especially in summer, because of the continual removal of soil moisture by deep-rooted trees. Soils that have a dry profile, such as DeKalb and Steinsburg soils, develop slowly.

Man has greatly altered the natural development of soil by clearing forests, draining swamps, plowing, and mining. He has mixed the soil horizons, moved soil

material from place to place, added lime and fertilizer, and introduced new plants. In some areas, changes made by man have been so drastic that different kinds of soils have formed. Fairpoint and Bethesda soils are examples. They formed by the mixing of soils and parent material during surface coal mining.

Parent Material

Parent material is the unconsolidated mass in which soil forms.

In the early stages of soil development, a soil has properties similar to those of the parent material. As weathering takes place, these properties are modified, and each soil develops its own characteristics. The soils in the survey area formed mostly in residuum and colluvium from bedrock and in stream alluvium washed from soils formed in residual material.

The bedrock of the survey area is sedimentary and consists primarily of acid shale, siltstone, and sandstone. Limestone is on the north side of Pine Mountain. The chemical and mineralogical content of the soil, its texture, and the depth to bedrock are greatly influenced by the kind of parent material in which the soils formed. DeKalb soils, for example, weathered from sandstone, are coarse textured, contain many coarse fragments, and have weak horizon development. In contrast, Latham soils developed in clayey shale, are fine textured and have clearly defined horizons.

Soils on flood plains and stream terraces developed in general alluvium from upland landforms. This alluvium is a mixture of material that was sorted as it was deposited. The coarser material was deposited near the stream channels and was the parent material of Pope, Allegheny, and Cotaco soils. The fine-textured sediment settled in slower moving or still water and became the parent material of Cuba, Morehead, and Whitley soils.

Most soils on benches and the lower half to two-thirds of the steep side slopes developed in gravity-carried colluvial material that is similar to the geological formations and soils on slopes above. Colluvial material is generally from two or more kinds of rock. Shelocta soils formed in material from shale, siltstone, and sandstone; Rigley soils in material from sandstone, siltstone, and a minor component of shale; and Bledsoe soils in material primarily of limestone but with a minor component of siltstone, sandstone, and shale.

Topography

Topography influences soils chiefly by its effect on drainage and erosion. The position, shape, and slope of the soil affect aeration, soil temperature, plant cover, and exposure to sun and wind.

The topography of Knox County and the eastern part of Whitley County ranges from nearly level valleys to narrow sloping ridges and steep to very steep side slopes. The maximum difference in elevation between the valleys and the adjacent hillcrests ranges from about 200 to 1,100 feet.

The shape of the land is generally related to the different rates of weathering of the underlying rocks. Shale weathers more rapidly than sandstone or siltstone; consequently landscapes underlain by shale have a rounded, highly dissected appearance. When shale, siltstone, and sandstone are interbedded, the landscape has a benched appearance and more abrupt changes in slope. Most soils that have steep slopes are deep because they developed in deep colluvial material that washed and crept downhill from ridges and very steep upper slopes. Examples are Shelocta, Rigley, and Bledsoe soils. The soils in the survey area that occur on narrow, steep or very steep ridgetops and on steep or very steep convex side slopes generally are moderately deep, mainly because of rapid geological erosion. Examples are DeKalb and Latham soils.

The depth of the water table is an important factor in profile development. Topography has an influence on the depth of the water table. In nearly level areas, some soils are saturated with water for extended periods. These soils are commonly mottled. Mottling results when iron is reduced and segregated, as in the lower horizons of Stendal, Stokly, and Newark soils. Gleying results when a horizon is subject to intense reduction during soil development. For example, horizons were intensively reduced during formation of Bonnie soils.

Gently sloping to sloping soils generally tend to show more clearly the influence of all the soil-forming factors. Although excess water runs off these soils, erosion is not excessive. This results in the development of a normal soil profile. Examples are the Allegheny and Wernock soils.

Time

Time is required for changes to take place in parent material and for uniquely different kinds of soil to develop. The length of time required for a soil to develop in the survey area depends mainly on the kind and nature of the parent material and the topography. The influence of climate and plant and animal life varies only slightly, according to whether the slopes face north or south.

DeKalb and Latham soils formed in different parent material in about the same length of time. DeKalb soils formed in residuum of resistant sandstone, and they have a weaker profile development than Latham soils, which formed in residuum of easily weathered soft shale.

When soils begin to form, they have characteristics almost identical to those of the parent material. Such soils are said to be immature or youthful. Examples of immature soils in the survey area are the Cuba and Pope soils on flood plains. These soils formed in recent sediment and have weak horizon development. The surface layer shows a slight increase in content of

organic matter, and the subsoil shows weak structure. After a long time, if no additional sediment is deposited, weathering occurs, some finer material moves into the subsoil, and the structure and color of the subsoil change. Allegheny and Whitley soils have undergone this maturing process. A soil is generally said to be mature when it has been in place long enough to acquire distinct profile characteristics. Latham, Lily, and Wernock soils are examples of mature soils.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vol., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Beck, Donald E. 1962. Yellow-poplar site index curves. U.S. Dep. Agric., Forest Serv., Southeast. Forest Exp. Stn. Res. Note 180, 2 pp., illus.

(4) Boisen, A.T. and J.A. Newlin. 1910. The commercial hickories. U.S. Dep. Agric., Forest Serv. Bull. No. 80.

(5) Broadfoot, W.M. and R.M. Krinard, 1959. Guide for evaluating sweetgum sites. U.S. Dep. Agr., Forest Serv., South. Forest Exp. Stn. Occas. Pap. 176, 8 pp., illus.

(6) Broadfoot, W.M. 1960. Field guide for evaluating cottonwood sites. U.S. Dep. Agric., Forest Serv., South. Forest Exp. Stn. Occas. Pap. 178, 6 pp., illus.

(7) Broadfoot, W.M. 1963. Guide for evaluating water oak sites. U.S. Dep. Agric., Forest Serv., South. Forest Exp. Stn. Res. Pap. SO-1, 8 pp., illus.

(8) Coile, T.S. and F.X. Schumacher. 1953. Site index of young stands of loblolly and shortleaf pines in the Piedmont Plateau Region. J. For. 51: 432-435, illus.

(9) Doolittle, Warren T. 1960. Site index curves for natural stands of white pine in the Southern Appalachians. U.S. Dep. Agric., Forest Serv., Southeast. Forest Exp. Stn. Res. Note 141.

(10) Evans, J. Kenneth and Gary Lacefield. 1977. Establishing forage crops. Univ. Ky., Coll. Agric., Coop. Ext. Serv., AGR-64, 2 pp.

(11) Evans, J. Kenneth, Gary Lacefield, T.H. Taylor, W.C. Templeton, Jr., and E.M. Smith. 1978. Renovating grass fields. Univ. Ky., Coll. Agric., Coop. Ext. Serv., AGR-26, 2 pp.

(12) Franzmeir, D.P., E.J. Pederson, T.J. Longwell, J.G. Byrne, and C.K. Losche. 1969. Properties of some soils in the Cumberland Plateau as related to slope aspect and position. Soil Sci. Soc. Am. Proc. 33: 755-761, illus.

(13) Kentucky Conservation Needs Committee. 1970. Kentucky soil and water conservation needs inventory. 256 pp., illus.

(14) Kentucky Crop and Livestock Reporting Service. 1983. 1982-1983 Kentucky Agricultural Statistics. 110 pp., illus.

(15) Kentucky Crop and Livestock Reporting Service. 1983. Knox County, Kentucky agricultural statistics, 1909-1981. 4 pp., illus.

(16) Kentucky Crop and Livestock Reporting Service. 1983. Whitley County, Kentucky agricultural statistics, 1909-1981. 4 pp., illus.

(17) Kentucky Department of Commerce and Knox County Chamber of Commerce. 1973. Industrial resources, Barbourville, Kentucky. Div. Res. and Plann. illus.

(18) Kentucky Department of Commerce and Williamsburg Chamber of Commerce. 1973. Industrial resources, Williamsburg, Kentucky. Div. Res. and Plann. illus.

(19) Kingsley, Neal P. and Douglas S. Powell. 1978. The forest resources of Kentucky. U.S. Dep. Agric., Forest Serv., Northeast. Forest Exp. Stn., Forest Resour. Bull. NE-54, 97 pp., illus.

(20) McFarlan, Arthur C. 1943. Geology of Kentucky. Univ. Ky., Lexington. 531 pp., illus.

(21) Nelson, T.C., J.L. Clutter, and L.E. Chaiken. 1961. Yield of Virginia pine. U.S. Dep. Agric. Forest Serv., Southeast. Forest Exp. Stn. Pap. 124, 11 pp.

(22) Olson, D.J. 1959. Site index curves for upland oak in the southeast. U.S. Dep. Agric. Forest Serv., Southeast. Forest Exp. Stn. Res. Note 125, 2 pp.

(23) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. (Supplements replacing pp. 173-188 issued May 1962.)

(24) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(25) United States Department of Agriculture. 1984. Procedures for collecting soil samples and methods of analysis for soil survey. Soil Surv. Invest. Rep. 1, 68 pp., illus.

(26) United States Department of Commerce. 1981. 1980 Census of population and housing in Kentucky. illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	Less than 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	more than 5.2

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels, i.e., clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A

fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Large stones (in tables). Rock fragments that are 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch

Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). There is a shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slippage (in tables). The soil mass is susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent

material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Thin layer (in tables). Otherwise suitable soil material is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Data recorded in the period 1951-80 at Barbourville, Kentucky]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	47.4	24.0	35.7	71	-9	111	4.58	2.64	6.29	9	6.6
February---	50.5	25.2	37.9	75	-2	135	4.10	2.07	5.86	9	3.7
March------	60.0	33.2	46.6	83	11	267	5.25	2.90	7.31	10	1.2
April------	71.6	42.0	56.8	89	24	504	4.40	2.68	5.92	9	.0
May--------	79.4	50.8	65.1	92	30	778	4.26	2.68	5.68	8	.0
June-------	85.1	59.1	72.1	95	43	963	4.66	2.83	6.29	8	.0
July-------	88.1	63.1	75.6	96	50	1,104	5.17	2.91	7.16	9	.0
August-----	87.4	62.4	74.9	97	48	1,082	3.58	1.95	5.00	7	.0
September--	82.6	55.6	69.1	96	36	873	3.51	1.83	4.96	6	.0
October----	71.6	42.2	56.9	88	22	524	2.82	1.53	4.00	5	.0
November---	59.8	33.3	46.6	80	13	219	3.92	2.20	5.43	7	1.7
December---	50.7	27.0	38.9	73	1	130	4.37	2.22	6.24	8	2.0
Yearly:											
Average--	69.5	43.2	56.4	---	---	---	---	---	---	---	---
Extreme--	---	---	---	98	-9	---	---	---	---	---	---
Total----	---	---	---	---	---	6,690	50.62	44.23	56.75	95	15.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 °F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data recorded in the period 1951-80
at Barbourville, Kentucky]

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 11	April 24	May 13
2 years in 10 later than--	April 5	April 18	May 7
5 years in 10 later than--	March 24	April 8	April 26
First freezing temperature in fall:			
1 year in 10 earlier than--	October 22	October 13	October 6
2 years in 10 earlier than--	October 28	October 19	October 10
5 years in 10 earlier than--	November 7	October 29	October 18

TABLE 3.--GROWING SEASON

[Data recorded in the period 1951-80
at Barbourville, Kentucky]

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	202	181	154
8 years in 10	211	189	161
5 years in 10	228	203	175
2 years in 10	245	218	189
1 year in 10	254	225	196

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Knox County	Whitley County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
AlB	Allegheny loam, 2 to 6 percent slopes	917	725	1,642	0.4
AlC	Allegheny loam, 6 to 12 percent slopes	956	1,422	2,378	0.6
AlD	Allegheny loam, 12 to 20 percent slopes	219	526	745	0.2
AnB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	265	581	846	0.2
AnC	Allegheny loam, 6 to 12 percent slopes, rarely flooded	153	104	257	0.1
AnD	Allegheny loam, 12 to 20 percent slopes, rarely flooded	21	87	108	*
BEF	Bledsoe-Shelocta-Rock outcrop complex, 15 to 90 percent slopes	0	804	804	0.2
Bo	Bonnie silt loam, frequently flooded	1,905	973	2,878	0.7
ClB	Clarkrange silt loam, 2 to 6 percent slopes	240	145	385	0.1
Co	Cotaco loam, rarely flooded	981	1,596	2,577	0.7
Cu	Cuba silt loam, frequently flooded	1,105	566	1,671	0.4
FBC	Fairpoint and Bethesda soils, 0 to 20 percent slopes	4,969	5,970	10,939	2.8
FBF	Fairpoint and Bethesda soils, 20 to 70 percent slopes	4,345	2,946	7,291	1.9
Hu	Huntington silt loam, occasionally flooded	2,608	1,237	3,845	1.0
LaC	Latham silt loam, 6 to 12 percent slopes	935	1,756	2,691	0.7
LaD	Latham silt loam, 12 to 20 percent slope	3,443	1,752	5,195	1.3
LDF	Latham-DeKalb complex, 30 to 60 percent slopes	53,312	19,509	72,821	18.8
LlC	Lily loam, 6 to 12 percent slopes	261	58	319	0.1
LSD	Lily-Steinsburg fine sandy loams, 12 to 30 percent slopes	0	1,128	1,128	0.3
Mo	Morehead silt loam, rarely flooded	2,354	1,888	4,242	1.1
Ne	Newark silt loam, occasionally flooded	1,409	749	2,158	0.6
Pd	Pits-Dumps complex	251	123	374	0.1
Pg	Pope gravelly fine sandy loam, frequently flooded	595	53	648	0.2
RSF	Rigley-Shelocta-Rock outcrop complex, 30 to 60 percent slopes	0	1,847	1,847	0.5
ShB	Shelocta gravelly silt loam, 2 to 6 percent slopes	818	363	1,181	0.3
ShC	Shelocta gravelly silt loam, 6 to 12 percent slopes	4,676	3,405	8,081	2.1
ShD	Shelocta gravelly silt loam, 12 to 20 percent slopes	2,155	1,936	4,091	1.1
SLE	Shelocta-Latham silt loams, 20 to 30 percent slopes	10,007	7,641	17,648	4.6
SLF	Shelocta-Latham silt loams, 30 to 60 percent slopes	126,844	64,978	191,822	49.5
SSF	Steinsburg-Shelocta-Rock outcrop complex, 35 to 80 percent slopes	0	796	796	0.2
St	Stendal silt loam, frequently flooded	11,961	6,441	18,402	4.7
Sv	Stokly fine sandy loam, frequently flooded	1,591	121	1,712	0.4
WnB	Wernock silt loam, 2 to 6 percent slopes	1,939	1,539	3,478	0.9
WnC	Wernock silt loam, 6 to 12 percent slopes	3,342	3,127	6,469	1.7
WnD	Wernock silt loam, 12 to 20 percent slopes	1,107	256	1,363	0.4
WtA	Whitley silt loam, 0 to 2 percent slopes, rarely flooded	404	188	592	0.2
WtB	Whitley silt loam, 2 to 6 percent slopes, rarely flooded	1,409	1,275	2,684	0.7
WtC	Whitley silt loam, 6 to 12 percent slopes, rarely flooded	586	292	878	0.2
	Water	45	0	45	*
	Total	248,128	138,903	387,031	100.0

* Less than 0.1 percent.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Land capability	Corn	Wheat	Tobacco	Soybeans	Alfalfa-hay	Grass-legume hay	Pasture
		Bu	Bu	Lbs	Bu	Tons	Tons	AUM*
AlB---------- Allegheny	IIe	120	45	3,000	40	5.0	4.6	8.5
AlC---------- Allegheny	IIIe	110	40	2,800	35	4.0	4.5	8.5
AlD---------- Allegheny	IVe	90	35	2,400	30	3.5	3.5	6.0
AnB---------- Allegheny	IIe	120	45	3,000	40	4.0	4.5	8.0
AnC---------- Allegheny	IIIe	110	40	2,800	35	4.0	4.5	8.0
AnD---------- Allegheny	IVe	90	35	2,400	30	3.5	3.5	6.0
BEF:								
Bledsoe--------	VIIe	---	---	---	---	---	---	---
Shelocta-------	VIIe	---	---	---	---	---	---	---
Rock outcrop---	VIIIs	---	---	---	---	---	---	---
Bo---------- Bonnie	IIIw	110	35	---	35	---	3.0	6.0
ClB---------- Clarkrange	IIe	110	40	2,500	35	3.5	4.0	7.0
Co---------- Cotaco	IIw	110	40	2,800	40	---	4.0	8.0
Cu---------- Cuba	IIw	120	45	---	40	4.0	4.0	9.0
FBC---------- Fairpoint and Bethesda	VIs	---	---	---	---	---	---	2.0
FBF---------- Fairpoint and Bethesda	VIIe	---	---	---	---	---	---	---
Hu---------- Huntington	IIw	130	50	3,200	45	5.5	4.5	9.5
LaC---------- Latham	IIIe	85	30	2,200	30	3.0	3.0	6.0
LaD---------- Latham	IVe	75	25	---	25	2.5	3.0	5.0
LDF---------- Latham-DeKalb	VIIe	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Corn	Wheat	Tobacco	Soybeans	Alfalfa-hay	Grass-legume hay	Pasture
		Bu	Bu	Lbs	Bu	Tons	Tons	AUM*
L1C---------- Lily	IIIe	85	30	2,500	30	2.5	3.0	6.5
LSD---------- Lily-Steinsburg	VIe	---	---	---	---	---	---	4.5
Mo---------- Morehead	IIw	110	40	2,800	40	---	4.0	8.0
Ne---------- Newark	IIw	120	40	2,500	40	---	4.5	8.5
Pd---------- Pits-Dumps	VIIIs	---	---	---	---	---	---	---
Pg---------- Pope	IIw	110	35	2,700	35	4.0	4.0	8.0
RSF:								
Rigley---------	VIIe	---	---	---	---	---	---	---
Shelocta-------	VIIe	---	---	---	---	---	---	---
Rock outcrop---	VIIIs	---	---	---	---	---	---	---
ShB---------- Shelocta	IIe	115	45	2,800	35	4.5	4.0	9.0
ShC---------- Shelocta	IIIe	110	40	2,700	30	4.0	4.0	8.0
ShD---------- Shelocta	IVe	90	35	2,400	---	3.5	4.0	7.0
SLE---------- Shelocta-Latham	VIe	---	---	---	---	---	---	6.0
SLF---------- Shelocta-Latham	VIIe	---	---	---	---	---	---	5.0
SSF:								
Steinsburg-----	VIIe	---	---	---	---	---	---	---
Shelocta-------	VIIe	---	---	---	---	---	---	---
Rock outcrop---	VIIIs	---	---	---	---	---	---	---
St---------- Stendal	IIw	120	40	2,500	40	---	4.0	8.5
Sv---------- Stokly	IIw	110	35	2,000	40	---	4.0	8.0
WnB---------- Wernock	IIe	110	40	2,800	35	4.0	4.0	8.0
WnC---------- Wernock	IIIe	90	35	2,600	30	4.0	4.0	8.0
WnD---------- Wernock	IVe	75	30	2,200	25	3.5	3.5	7.0

See footnote at end of table.

TABLE 5.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Land capability	Corn	Wheat	Tobacco	Soybeans	Alfalfa-hay	Grass-legume hay	Pasture
		Bu	Bu	Lbs	Bu	Tons	Tons	AUM*
WtA---------- Whitley	I	125	45	3,000	40	5.0	4.5	8.5
WtB---------- Whitley	IIe	115	40	3,000	40	5.0	4.5	8.5
WtC---------- Whitley	IIIe	100	35	2,800	35	4.0	4.0	8.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Dashes indicate no acreage]

Class	Total Acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I:				
Knox County	404	---	---	---
Whitley County	188	---	---	---
II:				
Knox County	28,192	5,588	22,604	---
Whitley County	17,279	4,628	12,651	---
III:				
Knox County	12,814	10,909	1,905	---
Whitley County	11,137	10,164	973	---
IV:				
Knox County	6,945	6,945	---	---
Whitley County	4,557	4,557	---	---
V:				
Knox County	---	---	---	---
Whitley County	---	---	---	---
VI:				
Knox County	14,976	10,007	---	4,969
Whitley County	14,739	8,769	---	5,970
VII:				
Knox County	184,501	184,501	---	---
Whitley County	90,419	90,419	---	2,986
VIII:				
Knox County	251	---	---	251
Whitley County	584	---	---	584

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
A1B, A1C---------- Allegheny	Slight	Slight	Slight	Severe	Shortleaf pine------	80	129	Eastern white pine, yellow-poplar, black walnut, shortleaf pine, white oak, white ash, northern red oak.
					Yellow-poplar-------	93	95	
					Virginia pine-------	72	112	
					Sugar maple---------	---	---	
					White ash-----------	---	---	
					Northern red oak----	---	---	
					American elm--------	---	---	
					Red maple-----------	---	---	
					Pignut hickory------	---	---	
					Black oak-----------	78	60	
					White oak-----------	70	52	
					Eastern redcedar----	---	---	
					Black cherry--------	---	---	
A1D---------- Allegheny	Moderate	Moderate	Slight	Severe	Shortleaf pine------	80	129	Eastern white pine, yellow-poplar, black walnut, shortleaf pine, white oak, white ash, northern red oak.
					Yellow-poplar-------	93	95	
					Virginia pine-------	72	112	
					Sugar maple---------	---	---	
					White ash-----------	---	---	
					Northern red oak----	---	---	
					American elm--------	---	---	
					Red maple-----------	---	---	
					Pignut hickory------	---	---	
					Black oak-----------	78	60	
					White oak-----------	70	52	
					Eastern redcedar----	---	---	
					Black cherry--------	---	---	
AnB, AnC---------- Allegheny	Slight	Slight	Slight	Severe	Shortleaf pine------	80	129	Eastern white pine, yellow-poplar, black walnut, shortleaf pine, white oak, white ash, northern red oak.
					Yellow-poplar-------	93	95	
					Virginia pine-------	72	112	
					Sugar maple---------	---	---	
					White ash-----------	---	---	
					Northern red oak----	---	---	
					American elm--------	---	---	
					Red maple-----------	---	---	
					Pignut hickory------	---	---	
					Black oak-----------	78	60	
					White oak-----------	70	52	
					Eastern redcedar----	---	---	
					Black cherry--------	---	---	
AnD---------- Allegheny	Moderate	Moderate	Slight	Severe	Shortleaf pine------	80	129	Eastern white pine, yellow-poplar, black walnut, shortleaf pine, white oak, white ash, northern red oak.
					Yellow-poplar-------	93	95	
					Virginia pine-------	72	112	
					Sugar maple---------	---	---	
					White ash-----------	---	---	
					Northern red oak----	---	---	
					American elm--------	---	---	
					Red maple-----------	---	---	
					Pignut hickory------	---	---	
					Black oak-----------	78	60	
					White oak-----------	70	52	
					Eastern redcedar----	---	---	
					Black cherry--------	---	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
BEF:								
Bledsoe (north slopes)	Severe	Severe	Slight	Severe	Yellow-poplar	104	114	Yellow-poplar, white ash, white oak, northern red oak.
					Black walnut	---	---	
					White ash	---	---	
					Slippery elm	---	---	
					Sugar maple	---	---	
					Black cherry	---	---	
Shelocta (north slopes)	Severe	Severe	Slight	Severe	Shortleaf pine	77	124	Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, northern red oak.
					Yellow-poplar	99	105	
					Cucumbertree	---	---	
					American beech	---	---	
					White oak	72	54	
					Red maple	---	---	
					Black oak	77	59	
Rock outcrop.								
Bo, Bonnie	Slight	Severe	Severe	Severe	Pin oak	90	86	Eastern cottonwood, American sycamore, sweetgum, baldcypress, pin oak.
					Eastern cottonwood	100	128	
					Sweetgum	---	---	
					American sycamore	---	---	
ClB, Clarkrange	Slight	Slight	Slight	Moderate	Northern red oak	70	52	Eastern white pine, yellow-poplar, shortleaf pine, white oak, northern red oak.
					Yellow-poplar	90	90	
					Eastern white pine	80	144	
					Virginia pine	70	109	
					Loblolly pine	76	---	
					Shortleaf pine	70	---	
					American beech	---	---	
Co, Cotaco	Slight	Slight	Slight	Moderate	Virginia pine	81	123	Eastern white pine, yellow-poplar, white oak, sweetgum, black oak.
					Yellow-poplar	95	98	
					Black oak	87	69	
					Sweet birch	---	---	
					White oak	83	65	
					American beech	---	---	
					Black walnut	---	---	
					Blackgum	---	---	
					Scarlet oak	---	---	
					American elm	---	---	
Cu, Cuba	Slight	Slight	Slight	Severe	Yellow-poplar	100	107	Eastern white pine, black walnut, white oak, yellow-poplar.
					Sweetgum	---	---	
					Virginia pine	77	118	
					Elm	---	---	
FBC, FBF:								
Fairpoint	Severe	Severe	Severe	Moderate	Loblolly pine	82	114	Eastern white pine, black locust, white oak, loblolly pine.
					Sweetgum	---	---	
					Black locust	---	---	
Bethesda	Severe	Severe	Moderate	Moderate	Loblolly pine	69	91	Eastern white pine, white oak, black locust, loblolly pine.
					Eastern cottonwood	---	---	
					Black oak	73	55	
					Black locust	---	---	
					Sweetgum	---	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
Hu---------- Huntington	Slight	Slight	Slight	Severe	Yellow-poplar-------	95	98	Yellow-poplar, northern red oak, black walnut, white oak, eastern white pine.
					Northern red oak----	85	67	
LaC---------- Latham	Moderate	Slight	Slight	Moderate	Shortleaf pine------	67	103	Virginia pine, shortleaf pine, white oak.
					Black oak----------	---	---	
					Virginia pine-------	---	---	
					White oak----------	---	---	
					Scarlet oak---------	67	49	
					Chestnut oak--------	56	39	
LaD---------- Latham	Moderate	Moderate	Slight	Moderate	Shortleaf pine------	67	103	Virginia pine, shortleaf pine, white oak.
					Black oak----------	---	---	
					Virginia pine-------	---	---	
					White oak----------	---	---	
					Scarlet oak---------	67	49	
					Chestnut oak--------	56	39	
LDF:								
Latham---------- (north slopes)	Severe	Severe	Moderate	Moderate	Shortleaf pine------	76	122	Shortleaf pine, eastern white pine, white oak.
					Black oak----------	---	---	
					Virginia pine-------	---	---	
					White oak----------	---	---	
					Chestnut oak--------	65	47	
DeKalb---------- (north slopes)	Moderate	Severe	Slight	Moderate	Yellow-poplar-------	94	97	Eastern white pine, shortleaf pine, white oak, yellow-poplar.
					Black oak----------	66	48	
					White oak----------	74	56	
					Chestnut oak--------	82	64	
					Hickory------------	---	---	
					American beech------	---	---	
					Sugar maple---------	---	---	
Latham---------- (south slopes)	Severe	Severe	Severe	Moderate	Shortleaf pine------	67	103	Northern red oak, Virginia pine, eastern white pine, white ash, white oak.
					Black oak----------	---	---	
					Virginia pine-------	---	---	
					White oak----------	---	---	
					Scarlet oak---------	67	49	
					Hickory------------	---	---	
					Chestnut oak--------	56	39	
DeKalb---------- (south slopes)	Moderate	Severe	Severe	Slight	Shortleaf pine------	67	103	Eastern white pine, Virginia pine.
					Black oak----------	62	45	
					White oak----------	62	45	
					Virginia pine-------	72	112	
					Red maple----------	---	---	
					Hickory------------	---	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
L1C---------- Lily	Slight	Slight	Slight	Moderate	Shortleaf pine------	63	95	Shortleaf pine, Virginia pine, white oak, eastern white pine, yellow-poplar, northern red oak.
					Virginia pine-------	72	112	
					Black oak-----------	---	---	
					White oak-----------	69	51	
					Hickory-------------	---	---	
					Red maple-----------	---	---	
					Southern red oak----	65	47	
					Scarlet oak---------	64	47	
					Chestnut oak--------	74	56	
					Yellow-poplar-------	89	88	
					Blackgum------------	---	---	
					American beech------	---	---	
LSD:								
Lily----------	Moderate	Moderate	Slight	Moderate	Shortleaf pine------	63	95	Shortleaf pine, Virginia pine, white oak, eastern white pine, yellow-poplar, northern red oak.
					Virginia pine-------	72	112	
					Black oak-----------	---	---	
					White oak-----------	69	51	
					Hickory-------------	---	---	
					Red maple-----------	---	---	
					Southern red oak----	65	47	
					Scarlet oak---------	64	47	
					Chestnut oak--------	74	56	
					Yellow-poplar-------	89	88	
					Blackgum------------	---	---	
					American beech------	---	---	
Steinsburg--------	Moderate	Moderate	Moderate	Moderate	Virginia pine-------	67	104	Eastern white pine, shortleaf pine, white oak.
					Black oak-----------	70	52	
					Scarlet oak---------	64	47	
					White oak-----------	68	50	
					Pignut hickory------	---	---	
					Chestnut oak--------	72	54	
					Shortleaf pine------	61	90	
Mo---------- Morehead	Slight	Moderate	Slight	Severe	Shortleaf pine------	84	138	Shortleaf pine, yellow-poplar, sweetgum, pin oak, eastern white pine.
					Yellow-poplar-------	82	75	
					White oak-----------	---	---	
					Pitch pine----------	---	---	
					Virginia pine-------	---	---	
					Red maple-----------	---	---	
					Pin oak-------------	---	---	
					Black oak-----------	---	---	
					White ash-----------	---	---	
					River birch---------	---	---	
Ne---------- Newark	Slight	Moderate	Moderate	Severe	Pin oak-------------	96	93	Eastern cottonwood, sweetgum, American sycamore.
					Eastern cottonwood--	89	100	
					Sweetgum------------	85	93	
					Green ash-----------	---	---	
					Cherrybark oak------	---	---	
					Shumard oak---------	---	---	
					Overcup oak---------	---	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
Pg---------- Pope	Slight	Slight	Slight	Severe	Yellow-poplar------- American beech------ White oak---------- Blackgum---------- American sycamore--- Northern red oak---- American basswood--- Eastern hemlock-----	96 --- 80 --- --- --- --- ---	100 --- 62 --- --- --- --- ---	Eastern white pine, yellow-poplar, black walnut, white oak, northern red oak, white ash, shortleaf pine.
RSF: Rigley---------- (north slopes)	Severe	Severe	Slight	Moderate	Shortleaf pine------ White oak---------- Black oak---------- Northern red oak---- Yellow-poplar------- American beech------ Hickory----------	80 75 78 --- 94 --- ---	129 57 60 --- 97 --- ---	White oak, northern red oak, yellow-poplar, eastern white pine, shortleaf pine.
Shelocta---------- (north slopes)	Severe	Severe	Slight	Severe	Shortleaf pine------ Yellow-poplar------- Cucumbertree-------- American beech------ White oak---------- Red maple---------- Black oak----------	77 99 --- --- 72 --- 77	124 105 --- --- 54 --- 59	Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, northern red oak.
Rigley---------- (south slopes)	Severe	Severe	Moderate	Moderate	White oak---------- Black oak---------- Hickory---------- Scarlet oak--------- American beech------ Shortleaf pine------	65 --- --- --- --- ---	47 --- --- --- --- ---	Eastern white pine, shortleaf pine, white oak.
Shelocta---------- (south slopes)	Severe	Severe	Moderate	Moderate	Black oak---------- White oak---------- Scarlet oak--------- Yellow-poplar------- American beech------ Blackgum---------- Red maple----------	70 65 70 --- --- --- ---	52 47 52 --- --- --- ---	Shortleaf pine, white oak, eastern white pine.
Rock outcrop.								
ShB, ShC---------- Shelocta	Slight	Slight	Slight	Severe	Shortleaf pine------ Yellow-poplar------- Cucumbertree-------- American beech------ White oak---------- Red maple---------- Black oak----------	77 99 --- --- 72 --- 77	124 105 --- --- 54 --- 59	Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, northern red oak.
ShD: Shelocta---------- (north slopes)	Moderate	Moderate	Slight	Severe	Shortleaf pine------ Yellow-poplar------- Cucumbertree-------- American beech------ White oak---------- Red maple---------- Black oak----------	77 99 --- --- 72 --- 77	124 105 --- --- 54 --- 59	Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, northern red oak.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
ShD:								
Shelocta (south slopes)	Moderate	Moderate	Moderate	Moderate	Black oak	70	52	Shortleaf pine, white oak, eastern white pine.
					White oak	65	47	
					Scarlet oak	70	52	
					Yellow-poplar	---	---	
					American beech	---	---	
					Blackgum	---	---	
					Red maple	---	---	
SLE:								
Shelocta (north slopes)	Moderate	Moderate	Slight	Severe	Shortleaf pine	77	124	Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, northern red oak.
					Yellow-poplar	99	105	
					Cucumbertree	---	---	
					American beech	---	---	
					White oak	72	54	
					Red maple	---	---	
					Black oak	77	59	
Latham (north slopes)	Moderate	Moderate	Moderate	Moderate	Shortleaf pine	76	122	Eastern white pine, white oak, shortleaf pine.
					Black oak	---	---	
					White oak	65	47	
					Virginia pine	---	---	
					Chestnut oak	65	47	
Shelocta (south slopes)	Moderate	Moderate	Moderate	Moderate	Black oak	70	52	Shortleaf pine, white oak, eastern white pine.
					White oak	65	47	
					Scarlet oak	70	52	
					Yellow-poplar	---	---	
					American beech	---	---	
					Blackgum	---	---	
					Red maple	---	---	
Latham (south slopes)	Severe	Moderate	Moderate	Moderate	Shortleaf pine	67	103	Northern red oak, Virginia pine, eastern white pine, white ash, white oak, shortleaf pine.
					Scarlet oak	67	49	
					Black oak	---	---	
					Virginia pine	61	93	
					White oak	61	44	
					Hickory	---	---	
					Chestnut oak	56	39	
SLF:								
Shelocta (north slopes)	Severe	Severe	Slight	Severe	Shortleaf pine	77	124	Yellow-poplar, black walnut, eastern white pine, shortleaf pine, white ash, white oak, northern red oak.
					Yellow-poplar	99	105	
					Cucumbertree	---	---	
					American beech	---	---	
					White oak	72	54	
					Red maple	---	---	
					Black oak	77	59	
Latham (north slopes)	Severe	Severe	Moderate	Moderate	Shortleaf pine	76	122	Virginia pine, northern red oak, eastern white pine, white ash, white oak.
					Chestnut oak	65	47	
					Black oak	---	---	
					Virginia pine	---	---	
					White oak	65	47	
					Hickory	---	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
SLF:								
Shelocta---------- (south slopes)	Severe	Severe	Moderate	Moderate	Black oak----------	70	52	Shortleaf pine, white oak, eastern white pine.
					White oak----------	65	47	
					Scarlet oak---------	70	52	
					Yellow-poplar-------	---	---	
					American beech------	---	---	
					Blackgum-----------	---	---	
					Red maple----------	---	---	
Latham---------- (south slopes)	Severe	Severe	Moderate	Moderate	Shortleaf pine------	67	103	Northern red oak, Virginia pine, eastern white pine, white ash, white oak.
					Scarlet oak---------	67	49	
					Black oak----------	---	---	
					Virginia pine-------	61	93	
					White oak----------	61	44	
					Chestnut oak--------	56	39	
					Hickory------------	---	---	
SSF:								
Steinburg--------- (south slopes)	Severe	Severe	Moderate	Moderate	Virginia pine-------	67	104	Eastern white pine, white oak, shortleaf pine.
					Black oak----------	70	52	
					Scarlet oak---------	64	47	
					White oak----------	68	50	
					Pignut hickory------	72	---	
Shelocta---------- (south slopes)	Severe	Severe	Moderate	Moderate	Black oak----------	70	52	Shortleaf pine, white oak, eastern white pine.
					White oak----------	65	47	
					Scarlet oak---------	70	52	
					Yellow-poplar-------	---	---	
					American beech------	---	---	
					Blackgum-----------	---	---	
					Red maple----------	---	---	
Rock outcrop.								
St---------- Stendal	Slight	Moderate	Moderate	Severe	Pin oak------------	90	86	Eastern white pine, baldcypress, American sycamore, green ash, sweetgum.
					Sweetgum-----------	85	93	
					Yellow-poplar-------	90	90	
					Virginia pine-------	90	---	
Sv---------- Stokly	Slight	Moderate	Moderate	Severe	Yellow-poplar-------	90	90	Eastern white pine, American sycamore, sweetgum, yellow-poplar.
					White oak----------	80	62	
					Black oak----------	80	62	
					Red maple----------	---	---	
					American sycamore---	---	---	
					White ash----------	---	---	
					River birch--------	---	---	
					Sweetgum-----------	---	---	
WnB, WnC---------- Wernock	Slight	Slight	Slight	Severe	Shortleaf pine------	70	110	Eastern white pine, shortleaf pine, white oak, northern red oak.
					White oak----------	71	53	
					Black oak----------	71	53	
					Scarlet oak---------	73	55	
					Chestnut oak--------	71	53	
					Red maple----------	---	---	
					Hickory------------	---	---	
					Northern red oak----	---	---	
					Yellow-poplar-------	---	---	
					American beech------	---	---	

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Productivity	
							$Ft^3/ac/yr$	
WnD---------- Wernock	Moderate	Moderate	Slight	Severe	Shortleaf pine------	70	110	Eastern white pine, shortleaf pine, white oak, northern red oak.
					White oak----------	71	53	
					Black oak----------	71	53	
					Scarlet oak---------	73	55	
					Chestnut oak--------	71	53	
					Red maple----------	---	---	
					Hickory------------	---	---	
					Northern red oak----	---	---	
					Yellow-poplar-------	---	---	
					American beech------	---	---	
WtA, WtB, WtC------ Whitley	Slight	Slight	Slight	Severe	Shortleaf pine------	72	114	Shortleaf pine, eastern white pine, white oak, yellow-poplar, black walnut.
					Virginia pine-------	69	107	
					White oak----------	---	---	
					Post oak-----------	---	---	
					Chestnut oak--------	---	---	
					Red maple----------	---	---	
					Hickory------------	---	---	

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AlB---- Allegheny	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
AlC---- Allegheny	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AlD---- Allegheny	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
AnB---- Allegheny	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight	Slight.
AnC---- Allegheny	Severe: flooding.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
AnD---- Allegheny	Severe: flooding, slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
BEF: Bledsoe----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Shelocta----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
Bo---- Bonnie	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: wetness, flooding.
ClB---- Clarkrange	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
Co---- Cotaco	Severe: flooding.	Moderate: wetness.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: wetness.
Cu---- Cuba	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
FBC: Fairpoint----	Moderate: small stones, slope, percs slowly.	Moderate: small stones, slope, percs slowly.	Severe: slope, small stones.	Severe: erodes easily.	Moderate: small stones, slope.
Bethesda----	Moderate: slope, small stones, percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: slope, small stones.	Slight	Moderate; droughty, slope, small stones.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FBF: Fairpoint	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope, erodes easily.	Severe: slope.
Bethesda	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope, erodes easily.	Severe: slope.
Hu Huntington	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
LaC Latham	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope, depth to rock.
LaD Latham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
LDF: Latham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
DeKalb	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
LlC Lily	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, depth to rock.
LSD: Lily	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Steinsburg	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Mo Morehead	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ne Newark	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
Pd: Pits.					
Dumps.					
Pg Pope	Severe: flooding.	Moderate: flooding, small stones.	Severe: small stones, flooding.	Moderate: flooding.	Severe: flooding.
RSF: Rigley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RSF:					
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
ShB Shelocta	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
ShC Shelocta	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
ShD Shelocta	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
SLE:					
Shelocta	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Latham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
SLF:					
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Latham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
SSF:					
Steinsburg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
St Stendal	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: flooding, wetness.	Severe: flooding.
Sv Stokly	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
WnB Wernock	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
WnC Wernock	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope, depth to rock.
WnD Wernock	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
WtA---------- Whitley	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
WtB---------- Whitley	Severe: flooding.	Slight----------	Moderate: slope.	Slight----------	Slight.
WtC---------- Whitley	Severe: flooding.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AlB---------- Allegheny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AlC---------- Allegheny	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AlD---------- Allegheny	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
AnB---------- Allegheny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AnC---------- Allegheny	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AnD---------- Allegheny	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BEF: Bledsoe----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Shelocta----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
Bo---------- Bonnie	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
ClB---------- Clarkrange	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Co---------- Cotaco	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
Cu---------- Cuba	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
FBC, FBF: Fairpoint----------	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Bethesda----------	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Hu---------- Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LaC---------- Latham	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LaD---------- Latham	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
LDF:										
Latham	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
DeKalb	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
L1C--Lily	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LSD:										
Lily	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Steinsburg	Poor	Fair	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
Mo--Morehead	Fair	Good	Good	Good	---	Fair	Poor	Good	Good	Poor.
Ne--Newark	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
Pd:										
Pits.										
Dumps.										
Pg--Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RSF:										
Rigley	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Shelocta	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
ShB--Shelocta	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ShC--Shelocta	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ShD--Shelocta	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
SLE:										
Shelocta	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Latham	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
SLF:										
Shelocta	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
SLF: Latham	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
SSF: Steinsburg	Very poor.	Poor	Good	Good	---	Very poor.	Very poor.	Poor	Fair	Very poor.
Shelocta	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
St Stendal	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good	Fair.
Sv Stokly	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
WnB Wernock	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WnC Wernock	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WnD Wernock	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
WtA Whitley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WtB Whitley	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WtC Whitley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AlB---------- Allegheny	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
AlC---------- Allegheny	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
AlD---------- Allegheny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AnB---------- Allegheny	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
AnC---------- Allegheny	Moderate: slope.	Severe: flooding.	Severe: flooding.	Severe: flooding, slope.	Moderate: slope, flooding.	Moderate: slope.
AnD---------- Allegheny	Severe: slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: slope.	Severe: slope.
BEF: Bledsoe----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Shelocta---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
Bo---------- Bonnie	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, wetness.	Severe: flooding, wetness.
ClB---------- Clarkrange	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: low strength.	Moderate: wetness.
Co---------- Cotaco	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Moderate: wetness.
Cu---------- Cuba	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
FBC: Fairpoint--------	Moderate: large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: slope, shrink-swell.	Severe: small stones, droughty.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FBC:						
Bethesda	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Severe: droughty.
FBF:						
Fairpoint	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: small stones, droughty, slope.
Bethesda	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: slope, slippage.	Severe: droughty, slope.
Hu Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
LaC Latham	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope, depth to rock.
LaD Latham	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
LDF:						
Latham	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
DeKalb	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.	Severe: slope.
L1C Lily	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Moderate: slope, depth to rock.
LSD:						
Lily	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Steinsburg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mo Morehead	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness.	Severe: wetness.
Ne Newark	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Pd: Pits. Dumps.						
Pg---------- Pope	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
RSF: Rigley----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Shelocta---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
ShB---------- Shelocta	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Slight---------	Moderate: small stones.
ShC---------- Shelocta	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
ShD---------- Shelocta	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SLE, SLF: Shelocta---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Latham----------	Severe: wetness, slope.	Severe: slope.	Severe: wetness, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
SSF: Steinsburg-------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Shelocta---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
St---------- Stendal	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.
Sv---------- Stokly	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
WnB---------- Wernock	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.	Moderate: thin layer.
WnC---------- Wernock	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WnD---------- Wernock	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
WtA, WtB---------- Whitley	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
WtC---------- Whitley	Moderate: slope.	Severe: flooding.	Severe: flooding.	Severe: flooding, slope.	Severe: low strength.	Moderate: slope.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AlB---- Allegheny	Slight----	Moderate: seepage, slope.	Moderate: too clayey.	Slight----	Fair: too clayey.
AlC---- Allegheny	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
AlD---- Allegheny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
AnB---- Allegheny	Moderate: flooding.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
AnC---- Allegheny	Moderate: flooding, slope.	Severe: flooding, slope.	Moderate: flooding, slope, too clayey.	Moderate: flooding, slope.	Fair: too clayey, slope.
AnD---- Allegheny	Severe: slope.	Severe: flooding, slope.	Severe: slope.	Severe: slope.	Poor: slope.
BEF:					
Bledsoe----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey, hard to pack.
Shelocta----	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
Bo---- Bonnie	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
ClB---- Clarkrange	Severe: percs slowly, wetness.	Severe: wetness.	Severe: depth to rock, wetness.	Moderate: wetness, depth to rock.	Fair: too clayey, thin layer.
Co---- Cotaco	Severe: wetness.	Severe: seepage, flooding.	Severe: wetness.	Severe: seepage, wetness.	Poor: small stones.
Cu---- Cuba	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FBC:					
Fairpoint	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey, large stones.	Moderate: slope.	Poor: small stones.
Bethesda	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey, large stones.	Moderate: slope.	Poor: small stones.
FBF:					
Fairpoint	Severe: percs slowly, slope, slippage.	Severe: slope.	Severe: slope, slippage.	Severe: slope.	Poor: small stones, slope.
Bethesda	Severe: percs slowly, slope, slippage.	Severe: slope.	Severe: slope, slippage.	Severe: slope.	Poor: small stones, slope.
Hu Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
LaC Latham	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
LaD Latham	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness, slope.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
LDF:					
Latham	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness, slope.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
DeKalb	Severe: slope, depth to rock, poor filter.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage, depth to rock.	Poor: slope, small stones, depth to rock.
LlC Lily	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
LSD:					
Lily	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: slope, depth to rock.
Steinsburg	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, thin layer, depth to rock.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Mo---------- Morehead	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Ne---------- Newark	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Pd: Pits.					
Dumps.					
Pg---------- Pope	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: small stones.
RSF: Rigley----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Shelocta----------	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
ShB---------- Shelocta	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock, seepage.	Moderate: depth to rock.	Fair: too clayey, small stones.
ShC---------- Shelocta	Moderate: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Moderate: depth to rock, slope.	Fair: too clayey, small stones, slope.
ShD---------- Shelocta	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: slope.
SLE, SLF: Shelocta----------	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: slope.
Latham----------	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, slope, wetness.	Severe: depth to rock, wetness, slope.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
SSF: Steinsburg----------	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage, depth to rock.	Poor: slope, thin layer, depth to rock.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SSF: Shelocta---------- Rock outcrop.	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: slope.
St---------- Stendal	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Sv---------- Stokly	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
WnB---------- Wernock	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
WnC---------- Wernock	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
WnD---------- Wernock	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: slope, depth to rock.
WtA, WtB---------- Whitley	Moderate: flooding.	Severe: flooding.	Moderate: too clayey, flooding.	Moderate: flooding.	Fair: too clayey.
WtC---------- Whitley	Moderate: flooding, slope.	Severe: slope.	Moderate: flooding, slope, too clayey.	Moderate: flooding, slope.	Fair: too clayey, slope.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
AlB Allegheny	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
AlC Allegheny	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
AlD Allegheny	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
AnB Allegheny	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
AnC Allegheny	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
AnD Allegheny	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
BEF: Bledsoe	Poor: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Shelocta	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
Bo Bonnie	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
ClB Clarkrange	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Co Cotaco	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Cu Cuba	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
FBC: Fairpoint	Fair: large stones, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
FBC:				
Bethesda	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
FBF:				
Fairpoint	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Bethesda	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Hu Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
LaC Latham	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
LaD Latham	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope, too clayey.
LDF:				
Latham	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
DeKalb	Poor: slope, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
L1C Lily	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, depth to rock.
LSD:				
Lily	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Steinsburg	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Mo Morehead	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ne Newark	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pd:				
Pits.				
Dumps.				

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
Pg---------- Pope	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
RSF:				
Rigley----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Shelocta----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
ShB, ShC---------- Shelocta	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
ShD---------- Shelocta	Fair: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
SLE, SLF:				
Shelocta----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Latham----------	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
SSF:				
Steinsburg----------	Poor: slope, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Shelocta----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
St---------- Stendal	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: wetness.
Sv---------- Stokly	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WnB---------- Wernock	Poor: low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
WnC---------- Wernock	Poor: low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
WnD---------- Wernock	Poor: low strength, depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
WtA, WtB---------- Whitley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
WtC---------- Whitley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition; it does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
AlB---------- Allegheny	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable--------	Favorable.
AlC, AlD---------- Allegheny	Moderate: seepage.	Severe: piping.	Deep to water----	Slope----------	Slope.
AnB---------- Allegheny	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable--------	Favorable.
AnC, AnD---------- Allegheny	Moderate: seepage.	Severe: piping.	Deep to water----	Slope----------	Slope.
BEF:					
Bledsoe----------	Severe: slope.	Moderate: hard to pack.	Deep to water----	Slope, erodes easily.	Slope, erodes easily.
Shelocta---------	Severe: slope.	Severe: piping.	Deep to water----	Slope----------	Slope.
Rock outcrop.					
Bo---------- Bonnie	Slight----------	Severe: ponding.	Ponding, flooding, frost action.	Erodes easily, ponding.	Wetness, erodes easily.
ClB---------- Clarkrange	Moderate: depth to rock, seepage.	Severe: piping.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, rooting depth, percs slowly.
Co---------- Cotaco	Moderate: seepage.	Severe: piping, wetness.	Favorable--------	Erodes easily, wetness.	Erodes easily, droughty.
Cu---------- Cuba	Moderate: seepage.	Severe: piping.	Deep to water----	Erodes easily, too sandy.	Erodes easily.
FBC:					
Fairpoint--------	Severe: slope.	Severe: piping.	Deep to water----	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
Bethesda---------	Severe: slope.	Severe: seepage, piping.	Deep to water----	Slope, large stones.	Large stones, slope, droughty.
FBF:					
Fairpoint--------	Severe: slope, slippage.	Severe: piping.	Deep to water----	Slope, large stones, erodes easily, slippage.	Large stones, slope, erodes easily.
Bethesda---------	Severe: slope, slippage.	Severe: seepage, piping.	Deep to water----	Slope, large stones, slippage.	Large stones, slope, droughty.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Hu---------- Huntington	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable--------	Favorable.
LaC, LaD---------- Latham	Severe: slope.	Severe: thin layer.	Percs slowly, depth to rock, frost action.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock, percs slowly.
LDF: Latham----------	Severe: slope.	Severe: thin layer.	Percs slowly, depth to rock, frost action.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock, percs slowly.
DeKalb----------	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope, large stones, depth to rock.	Slope, large stones, droughty.
LlC---------- Lily	Severe: seepage.	Severe: piping.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
LSD: Lily----------	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope, depth to rock.	Slope, depth to rock.
Steinsburg-------	Severe: seepage, slope.	Moderate: thin layer, piping, seepage.	Deep to water----	Depth to rock, slope.	Slope, droughty, depth to rock.
Mo---------- Morehead	Moderate: seepage.	Severe: piping, wetness.	Favorable--------	Erodes easily, wetness.	Wetness, erodes easily.
Ne---------- Newark	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Pd: Pits. Dumps.					
Pg---------- Pope	Severe: seepage.	Severe: seepage, piping.	Deep to water----	Favorable--------	Droughty.
RSF: Rigley----------	Severe: seepage, slope.	Severe: piping.	Deep to water----	Slope----------	Slope.
Shelocta---------	Severe: slope.	Severe: piping.	Deep to water----	Slope----------	Slope.
Rock outcrop.					
ShB---------- Shelocta	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water----	Favorable--------	Favorable.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
ShC, ShD---------- Shelocta	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water----	Slope----------	Slope.
SLE, SLF: Shelocta---------	Severe: slope.	Severe: piping.	Deep to water----	Slope----------	Slope.
Latham----------	Severe: slope.	Severe: thin layer.	Percs slowly, depth to rock, frost action.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
SSF: Steinsburg-------	Severe: seepage, slope.	Moderate: thin layer, piping, seepage.	Deep to water----	Depth to rock, slope.	Slope, droughty, depth to rock.
Shelocta---------	Severe: slope.	Severe: piping.	Deep to water----	Slope----------	Slope.
Rock outcrop.					
St---------- Stendal	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Sv---------- Stokly	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness----------	Wetness.
WnB---------- Wernock	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water----	Depth to rock, erodes easily.	Erodes easily, depth to rock.
WnC, WnD---------- Wernock	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water----	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
WtA, WtB---------- Whitley	Moderate: seepage.	Severe: piping.	Deep to water----	Erodes easily----	Erodes easily.
WtC---------- Whitley	Moderate: seepage.	Severe: piping.	Deep to water----	Slope, erodes easily.	Slope, erodes easily.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
A1B, A1C, A1D, AnB, AnC, AnD--- Allegheny	0-8	Loam----------	ML, CL, CL-ML	A-4	0	90-100	80-100	65-100	55-95	<35	NP-10
	8-54	Clay loam, loam, sandy clay loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	80-100	65-95	35-80	<35	NP-15
	54-94	Clay loam, sandy loam, gravelly sandy loam.	SM, GC, ML, CL	A-4, A-6, A-2, A-1	0-5	65-100	55-100	35-95	20-75	<35	NP-15
BEF:											
Bledsoe---------	0-6	Gravelly silt loam.	CL, CL-ML	A-4, A-6	0-5	85-95	80-95	70-90	50-90	20-35	5-15
	6-58	Silty clay, silty clay loam, gravelly silty clay.	CH, CL	A-7, A-6	0-15	65-95	65-95	60-90	50-90	35-60	15-35
	58-62	Gravelly silty clay loam, silty clay, clay.	CH, CL, GC, SC	A-7, A-6	0-25	50-100	50-100	40-90	35-90	35-60	15-40
Shelocta--------	0-6	Silt loam--------	ML, CL-ML	A-4	0-5	80-95	75-95	60-95	55-90	<35	NP-10
	6-48	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	48-74	Channery silt loam, channery silty clay loam, very channery clay loam.	GM, GC, ML, CL	A-4, A-6, A-2, A-1-B	0-15	40-85	35-70	25-70	20-65	20-40	3-20
Rock outcrop.											
Bo---------- Bonnie	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	7-26	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	27-34	8-12
	26-64	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	100	90-100	80-100	25-39	8-15
ClB---------- Clarkrange	0-8	Silt loam--------	ML, CL, CL-ML	A-4	0	90-100	85-100	75-100	60-100	20-35	4-15
	8-26	Silt loam, silty clay loam, loam.	CL, CL-ML, ML	A-4, A-6	0	90-100	85-100	75-100	65-100	25-40	5-20
	26-50	Silt loam, silty clay loam, loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	75-100	65-100	25-45	4-25
	50-72	Silt loam, silty clay loam, silty clay.	CL, CH, CL-ML	A-4, A-6, A-7	0-30	70-100	65-85	60-85	55-80	25-60	5-35
	72	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Co---------- Cotaco	0-6	Loam----------	ML, CL-ML, SM, SM-SC	A-4	0-5	80-100	75-95	55-85	35-80	<30	NP-7
	6-41	Gravelly sandy clay loam, clay loam, loam.	SC, SM, GC, CL	A-2, A-4, A-6, A-1-B	0-10	60-100	50-95	40-70	20-70	<35	NP-15
	41-70	Gravelly silt loam, clay loam, loam.	SC, SM, GC, CL	A-2, A-4, A-6, A-1-B	0-10	60-100	50-95	40-70	20-70	<35	NP-15

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Cu---------- Cuba	0-45	Silt loam---------	CL, ML, CL-ML	A-4, A-6	0	100	95-100	90-100	70-90	25-35	3-12
	45-72	Stratified silt loam to fine sand.	CL, ML, CL-ML	A-4	0	100	80-100	75-100	50-85	16-30	2-10
FBC, FBF:											
Fairpoint-------	0-12	Gravelly silt loam.	CL, SC, GC	A-6, A-7	5-15	55-90	45-85	40-85	35-80	35-50	12-24
	12-60	Gravelly clay loam, very shaly silty clay loam.	GC, GM, CL, CL-ML, SC	A-4, A-6, A-7, A-2	15-30	55-75	25-65	20-65	15-60	25-50	4-24
Bethesda--------	0-12	Channery silt loam.	CL, SC, GC	A-6, A-7	0-10	65-90	55-80	50-80	40-75	35-50	12-24
	12-72	Very channery loam, very gravelly silty clay loam.	SC-SM, GM, GC, CL-ML	A-4, A-6, A-7, A-2	10-30	40-90	25-80	20-75	18-60	24-50	3-23
Hu---------- Huntington	0-10	Silt loam---------	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	10-44	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	44-62	Stratified sandy clay loam to silt loam.	SM, SC, ML, CL	A-2, A-4	0	95-100	60-100	50-90	30-75	<30	NP-10
LaC, LaD--------- Latham	0-6	Silt loam---------	CL-ML, CL	A-4, A-6	0-5	85-100	75-100	70-100	65-90	20-35	5-12
	6-24	Silty clay, silty clay loam, channery silty clay.	CH, CL, MH	A-7	0-10	85-100	70-100	65-100	60-96	45-70	25-40
	24-35	Weathered bedrock	---	---	---	---	---	---	---	---	---
LDF:											
Latham----------	0-6	Silt loam---------	CL-ML, CL	A-4, A-6	0-5	85-100	75-100	70-100	65-90	20-35	5-12
	6-24	Silty clay, silty clay loam, channery silty clay.	CH, CL, MH	A-7	0-10	85-100	70-100	65-100	60-95	45-70	25-40
	24-35	Weathered bedrock	---	---	---	---	---	---	---	---	---
DeKalb----------	0-6	Sandy loam-------	ML, CL-ML	A-4	0-5	80-90	75-85	70-80	55-70	<32	NP-10
	6-20	Channery sandy loam, channery loam, very channery sandy loam.	SM, GM, ML, GM-GC	A-2, A-4, A-1	5-40	50-85	40-80	40-75	20-55	<32	NP-9
	20-31	Channery sandy loam, flaggy sandy loam, very flaggy loamy sand.	SM, GM, SC, GC	A-2, A-4, A-1	10-50	45-85	25-75	20-65	15-40	<32	NP-9
	31	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
L1C---------- Lily	0-6	Loam----------	ML	A-4	0-5	90-100	85-100	70-95	55-75	<35	NP-7
	6-17	Clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	75-100	40-80	<35	3-15
	17-26	Sandy clay loam, clay loam, gravelly sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6, A-1-B	0-10	65-100	50-100	40-95	20-75	<35	3-15
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LSD: Lily----------	0-6	Fine sandy loam	SM	A-4, A-2	0-5	90-100	85-100	55-80	25-50	<20	NP-4
	6-17	Clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	75-100	40-80	<35	3-15
	17-26	Sandy clay loam, clay loam, gravelly sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6, A-1-B	0-10	65-100	50-100	40-95	20-75	<35	3-15
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Steinsburg------	0-6	Fine sandy loam	ML, SM	A-4	0-5	95-100	90-100	65-90	35-70	<25	5-10
	6-20	Loam, gravelly sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4, A-1	0-10	75-95	65-85	35-60	15-40	<25	NP-5
	20-29	Gravelly sandy loam, very gravelly loamy sand.	SM, GM	A-2, A-1	10-40	45-85	40-80	35-60	15-35	<25	NP-3
	29-34	Weathered bedrock	---	---	---	---	---	---	---	---	---
Mo---------- Morehead	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	95-100	90-100	80-100	25-35	2-10
	6-49	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	75-100	25-40	5-20
	49-67	Silt loam, loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	70-100	60-95	20-40	2-20
Ne---------- Newark	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	55-95	<32	NP-10
	9-40	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-95	22-42	3-20
	40-85	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	75-100	70-100	65-100	55-95	22-42	3-20
Pd: Pits----------	---	----------	---	---	---	---	---	---	---	---	---
Dumps----------	---	Variable---------	---	---	---	---	---	---	---	---	---
Pg---------- Pope	0-8	Gravelly fine sandy loam.	GM-GC, GM, SM, SM-SC	A-1-B, A-2-4, A-4	0-5	65-85	55-75	35-65	20-40	<20	NP-5
	8-32	Gravelly fine sandy loam, gravelly sandy loam, gravelly loam.	GM, GM-GC, ML, SM	A-2-4, A-4, A-1-B	0-5	65-85	55-75	35-70	20-55	<30	NP-7
	32-60	Gravelly fine sandy loam, gravelly loam, gravelly sandy loam.	GM, GM-GC, GW-GM, SM	A-2-4, A-1, A-4	0-20	40-80	30-75	20-70	10-55	<30	NP-7

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RSF:											
Rigley----------	0-10	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0-10	80-95	75-90	55-80	25-65	<30	NP-7
	10-45	Gravelly sandy loam, gravelly loam, sandy loam.	SM, ML, GM, GM-GC	A-2, A-4, A-1	0-10	65-95	60-90	40-75	20-60	<30	NP-7
	45-62	Gravelly sandy loam, gravelly loam, gravelly clay loam.	GM, GC, SM, SC	A-2, A-1, A-4, A-6	0-20	55-80	45-70	30-60	15-50	<35	NP-15
Shelocta--------	0-6	Silt loam--------	ML, CL-ML	A-4	0-5	80-95	75-95	60-95	55-95	<35	NP-10
	6-48	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-100	50-100	45-95	40-90	25-40	4-15
	48-74	Channery silt loam, channery silty clay loam, very channery clay loam.	GM, GC, ML, CL	A-4, A-6, A-2, A-1-B	0-15	40-85	35-70	25-70	20-65	20-40	3-20
Rock outcrop.											
ShB, ShC, ShD, Shelocta--------	0-9	Gravelly silt loam.	ML, GM, SM	A-4	0-10	55-95	50-80	40-70	36-65	<35	NP-10
	9-42	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	42-60	Channery silt loam, channery silty clay loam, very channery clay loam.	GM, GC, ML, CL	A-4, A-6, A-2, A-1-B	0-15	40-85	35-70	25-70	20-65	20-40	3-20
SLE, SLF:											
Shelocta--------	0-6	Gravelly silt loam.	ML, GM, SM	A-4	0-10	55-95	50-80	40-70	36-65	<35	NP-10
	6-48	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	48-74	Channery silt loam, channery silty clay loam, very channery clay loam.	GM, GC, ML, CL	A-4, A-6, A-2, A-1-B	0-15	40-85	35-70	25-70	20-65	20-40	3-20
Latham----------	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0-5	85-100	75-100	70-100	65-90	20-35	5-12
	6-24	Silty clay, silty clay loam, channery silty clay.	CH, CL, MH	A-7	0-10	85-100	70-100	65-100	60-95	45-70	25-40
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SSF:											
Steinsburg------	0-6	Fine sandy loam	ML, SM	A-4	0-5	95-100	90-100	65-90	35-70	<25	5-10
	6-20	Loam, gravelly sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4, A-1	0-10	75-95	65-85	35-60	15-40	<25	NP-5
	20-29	Gravelly sandy loam, very gravelly loamy sand.	SM, GM	A-2, A-1	10-40	45-85	40-80	35-60	15-35	<25	NP-3
	29-34	Weathered bedrock	---	---	---	---	---	---	---	---	---
Shelocta---------	0-6	Silt loam--------	ML, CL-ML	A-4	0-5	80-95	75-95	60-95	55-90	<35	NP-10
	6-48	Silty clay loam, silt loam, channery silty clay loam.	CL, CL-ML, GC, SC	A-6, A-4	0-10	55-95	50-95	45-95	40-90	25-40	4-15
	48-74	Channery silt loam, channery silty clay loam, very channery clay loam.	GM, GC, ML, CL	A-4, A-6, A-2, A-1-B	0-15	40-85	35-70	25-70	20-65	20-40	3-20
Rock outcrop.											
St--------------- Stendal	0-8	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
Sv--------------- Stokly	0-35	Fine sandy loam	ML, SM, SC, SM-SC	A-4	0	85-100	80-100	65-90	35-65	<30	NP-10
	35-60	Gravelly sandy loam, gravelly loam, loamy sand.	SM, SC, GM, GC	A-1-B, A-2-4, A-4	0	65-100	60-100	45-70	15-45	<30	NP-10
WnB, WnC, WnD---- Wernock	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	75-95	55-90	25-35	4-11
	5-34	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	90-100	85-100	75-100	55-95	25-45	4-22
	34-38	Silt loam, silty clay loam, channery clay loam.	ML, CL, CL-ML, GC	A-4, A-6, A-7	0-20	55-100	50-100	45-95	40-95	25-45	4-22
	38-42	Weathered bedrock	---	---	---	---	---	---	---	---	---
WtA, WtB, WtC---- Whitley	0-8	Silt loam--------	ML, CL	A-4	0	95-100	90-100	75-100	60-95	<35	NP-10
	8-34	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	95-100	90-100	85-100	70-100	20-40	5-20
	34-52	Silt loam, gravelly silty clay loam.	ML, CL, SM, SC	A-6, A-4	0	75-100	50-100	45-95	36-90	20-40	2-20
	52-72	Clay loam, silt loam, very gravelly sandy loam.	GC, GM, CL, ML	A-2, A-4, A-1-B, A-6	0-25	45-100	35-100	30-90	15-80	<30	NP-15

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
AlB, AlC, AlD, AnB, AnC, AnD--- Allegheny	0-8	15-27	1.20-1.40	0.6-2.0	0.12-0.22	3.6-5.5	Low----------	0.32	4	1-4
	8-54	18-35	1.20-1.50	0.6-2.0	0.13-0.18	3.6-5.5	Low----------	0.28		
	54-94	10-35	1.20-1.40	0.6-2.0	0.08-0.17	3.6-5.5	Low----------	0.28		
BEF:										
Bledsoe---------	0-6	15-27	1.20-1.50	0.6-2.0	0.16-0.21	6.1-7.8	Low----------	0.37	4	---
	6-58	35-50	1.30-1.60	0.2-0.6	0.12-0.19	6.1-7.8	Moderate-----	0.32		
	58-62	30-60	1.35-1.60	0.06-0.6	0.12-0.19	6.1-7.8	Moderate-----	0.32		
Shelocta--------	0-6	10-25	1.15-1.30	0.6-2.0	0.16-0.22	4.5-5.5	Low----------	0.32	4	.5-5
	6-48	18-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28		
	48-74	15-34	1.30-1.55	0.6-6.0	0.08-0.16	4.5-5.5	Low----------	0.17		
Rock outcrop.										
Bo--------------- Bonnie	0-7	18-27	1.20-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	5	1-3
	7-26	18-27	1.40-1.60	0.2-0.6	0.20-0.22	4.5-5.5	Low----------	0.43		
	26-64	18-30	1.45-1.65	0.2-0.6	0.18-0.20	4.5-5.5	Low----------	0.43		
ClB--------------- Clarkrange	0-8	10-25	1.20-1.55	0.6-2.0	0.16-0.22	4.5-5.5	Low----------	0.43	3	1-3
	8-26	18-35	1.30-1.55	0.6-2.0	0.16-0.22	4.5-5.5	Low----------	0.43		
	26-50	18-35	1.40-1.65	0.06-0.2	0.08-0.12	4.5-5.5	Low----------	0.43		
	50-72	10-50	1.40-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Low----------	0.43		
	72	---	---	---	---	---	----------	----		
Co--------------- Cotaco	0-6	7-27	1.20-1.40	0.6-6.0	0.12-0.20	3.6-5.5	Low----------	0.37	3	.5-4
	6-41	18-35	1.20-1.50	0.6-2.0	0.07-0.15	3.6-5.5	Low----------	0.28		
	41-70	18-35	1.20-1.50	0.6-2.0	0.07-0.15	3.6-5.5	Low----------	0.28		
Cu--------------- Cuba	0-45	18-25	1.30-1.45	0.6-2.0	0.22-0.24	4.5-5.5	Low----------	0.37	5	1-3
	45-72	14-20	1.45-1.65	0.6-2.0	0.19-0.21	4.5-5.5	Low----------	0.37		
FBC, FBF:										
Fairpoint-------	0-12	18-27	1.40-1.55	0.6-2.0	0.05-0.18	5.6-7.3	Low----------	0.37	5	<.5
	12-60	18-35	1.60-1.80	0.2-0.6	0.03-0.10	5.6-7.3	Moderate-----	0.37		
Bethesda--------	0-12	18-27	1.40-1.55	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.32	5	<.5
	12-72	18-35	1.60-1.90	0.2-0.6	0.04-0.10	3.6-5.5	Low----------	0.32		
Hu--------------- Huntington	0-10	18-30	1.10-1.30	0.6-2.0	0.18-0.24	5.6-7.8	Low----------	0.28	5	3-6
	10-44	18-30	1.30-1.50	0.6-2.0	0.16-0.22	5.6-7.8	Low----------	0.32		
	44-62	15-30	1.30-1.50	0.6-2.0	0.10-0.16	5.6-7.8	Low----------	0.28		
LaC, LaD--------- Latham	0-6	20-27	1.30-1.50	0.6-2.0	0.16-0.20	3.6-6.5	Low----------	0.43	3	1-3
	6-24	35-55	1.40-1.70	0.06-0.2	0.11-0.15	3.6-5.0	High---------	0.32		
	24-35	---	---	---	---	---	----------	----		
LDF:										
Latham----------	0-6	20-27	1.30-1.50	0.6-2.0	0.16-0.20	3.6-6.5	Low----------	0.43	3	1-3
	6-24	35-55	1.40-1.70	0.06-0.2	0.11-0.15	3.6-5.0	High---------	0.32		
	24-35	---	---	---	---	---	----------	----		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
LDF:										
DeKalb----------	0-6	10-20	1.20-1.50	6.0-20	0.08-0.12	3.6-6.5	Low----------	0.24	2	2-4
	6-20	7-18	1.20-1.50	6.0-20	0.06-0.12	3.6-5.5	Low----------	0.17		
	20-31	5-15	1.20-1.50	>6.0	0.05-0.10	3.6-5.5	Low----------	0.17		
	31	---	---	---	---	---	----------	----		
L1C----------	0-6	7-27	1.20-1.40	0.6-6.0	0.13-0.18	3.6-5.5	Low----------	0.28	3	.5-4
Lily	6-17	18-35	1.25-1.35	2.0-6.0	0.12-0.18	3.6-5.5	Low----------	0.28		
	17-26	20-35	1.25-1.35	2.0-6.0	0.08-0.17	3.6-5.5	Low----------	0.17		
	26	---	---	---	---	---	----------	----		
LSD:										
Lily----------	0-6	5-20	1.20-1.40	2.0-6.0	0.09-0.16	3.6-5.5	Low----------	0.28	3	.5-4
	6-17	18-35	1.25-1.35	2.0-6.0	0.12-0.18	3.6-5.5	Low----------	0.28		
	17-26	20-35	1.25-1.35	2.0-6.0	0.08-0.17	3.6-5.5	Low----------	0.17		
	26	---	---	---	---	---	----------	----		
Steinsburg------	0-6	10-20	1.20-1.40	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.28	2	1-3
	6-20	10-20	1.20-1.40	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.20		
	20-29	5-18	1.10-1.40	2.0-6.0	0.04-0.08	3.6-5.5	Low----------	0.20		
	29-34	---	---	---	---	---	----------	----		
Mo----------	0-6	12-27	1.20-1.50	0.6-2.0	0.19-0.23	4.5-5.5	Low----------	0.37	4	1-4
Morehead	6-49	16-35	1.20-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.43		
	49-67	7-40	1.20-1.50	0.6-2.0	0.15-0.22	4.5-5.5	Low----------	0.43		
Ne----------	0-9	7-27	1.20-1.40	0.6-2.0	0.15-0.23	5.6-7.8	Low----------	0.43	5	1-4
Newark	9-40	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.6-7.8	Low----------	0.43		
	40-85	12-40	1.30-1.50	0.6-2.0	0.15-0.22	5.6-7.8	Low----------	0.43		
Pd:										
Pits.										
Dumps.										
Pg----------	0-8	5-15	1.20-1.40	2.0-6.0	0.06-0.13	4.5-5.5	Low----------	0.28	5	1-4
Pope	8-32	5-18	1.30-1.60	0.6-6.0	0.08-0.12	4.5-5.5	Low----------	0.28		
	32-60	5-20	1.30-1.60	0.6-6.0	0.05-0.12	4.5-5.5	Low----------	0.28		
RSF:										
Rigley----------	0-10	7-18	1.20-1.40	2.0-6.0	0.09-0.15	4.5-7.3	Low----------	0.24	4	.5-3
	10-45	7-18	1.30-1.60	2.0-6.0	0.09-0.15	3.6-5.5	Low----------	0.17		
	45-62	7-40	1.30-1.60	2.0-6.0	0.07-0.15	3.6-5.5	Low----------	0.17		
Shelocta--------	0-6	10-25	1.15-1.30	0.6-2.0	0.16-0.22	4.5-5.5	Low----------	0.32	4	.5-5
	6-48	12-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28		
	48-74	15-34	1.30-1.55	0.6-6.0	0.08-0.16	4.5-5.5	Low----------	0.17		
Rock outcrop.										
ShB, ShC, ShD----	0-9	10-25	1.15-1.30	0.6-2.0	0.10-0.18	4.5-5.5	Low----------	0.28	4	.5-5
Shelocta	9-42	12-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28		
	42-60	15-34	1.30-1.55	0.6-6.0	0.08-0.16	4.5-5.5	Low----------	0.17		
SLE, SLF:										
Shelocta--------	0-6	10-25	1.15-1.30	0.6-2.0	0.10-0.18	4.5-5.5	Low----------	0.28	4	.5-5
	6-48	12-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28		
	48-74	15-34	1.30-1.55	0.6-6.0	0.08-0.16	4.5-5.5	Low----------	0.17		

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
SLE, SLF:										
Latham----------	0-6	20-27	1.30-1.50	0.6-2.0	0.16-0.20	3.6-6.5	Low----------	0.43	3	1-3
	6-24	35-55	1.40-1.70	0.06-0.2	0.11-0.15	3.6-5.0	High---------	0.32		
	24	---	---	---	---	---	----------	----		
SSF:										
Steinsburg------	0-6	10-20	1.20-1.40	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.28	2	1-3
	6-20	10-20	1.20-1.40	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.20		
	20-29	5-18	1.10-1.40	2.0-6.0	0.04-0.08	3.6-5.5	Low----------	0.20		
	29-34	---	---	---	---	---	----------	----		
Shelocta--------	0-6	10-25	1.15-1.30	0.6-2.0	0.16-0.22	4.5-5.5	Low----------	0.32	4	.5-5
	6-48	12-34	1.30-1.55	0.6-2.0	0.10-0.20	4.5-5.5	Low----------	0.28		
	48-74	15-34	1.30-1.55	0.6-6.0	0.08-0.16	4.5-5.5	Low----------	0.17		
Rock outcrop.										
St----------	0-8	18-27	1.30-1.45	0.6-2.0	0.22-0.24	4.5-6.5	Low----------	0.37	5	1-3
Stendal	8-60	18-35	1.45-1.65	0.6-2.0	0.20-0.22	4.5-5.5	Low----------	0.37		
Sv----------	0-35	5-18	1.30-1.65	2.0-6.0	0.10-0.18	3.6-7.3	Low----------	0.28	3	1-4
Stokly	35-60	7-18	1.35-1.65	2.0-6.0	0.08-0.18	3.6-5.5	Low----------	0.17		
WnB, WnC, WnD----	0-5	12-27	1.20-1.40	0.6-2.0	0.19-0.23	3.6-7.3	Low----------	0.37	3	.5-4
Wernock	5-34	18-35	1.30-1.50	0.6-2.0	0.18-0.22	3.6-5.5	Low----------	0.32		
	34-38	18-35	1.30-1.50	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.28		
	38-42	---	---	---	---	---	----------	----		
WtA, WtB, WtC----	0-8	7-27	1.20-1.40	0.6-2.0	0.16-0.23	4.5-5.5	Low----------	0.37	4	1-4
Whitley	8-34	18-35	1.30-1.50	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37		
	34-52	12-35	1.30-1.50	0.6-2.0	0.10-0.18	4.5-5.5	Low----------	0.32		
	52-72	5-30	1.30-1.50	0.6-2.0	0.05-0.18	4.5-5.5	Low----------	0.28		

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
AlB, AlC, AlD----- Allegheny	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High.
AnB, AnC, AnD----- Allegheny	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High.
BEF:											
Bledsoe----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Shelocta---------	B	None--------	---	---	>6.0	---	---	>48	Hard	Low------	High.
Rock outcrop.											
Bo---------- Bonnie	C/D	Frequent----	Very brief	Jan-Jun	0.5-1.0	Apparent	Jan-June	>60	---	High-----	High.
ClB---------- Clarkrange	C	None--------	---	---	1.5-2.5	Perched	Jan-Apr	>40	Hard	High-----	High.
Co---------- Cotaco	C	Rare--------	---	---	0.5-1.5	Apparent	Nov-May	>60	---	Moderate	High.
Cu---------- Cuba	B	Frequent----	Very brief	Jan-May	>6.0	---	---	>60	---	Low------	High.
FBC, FBF:											
Fairpoint--------	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Bethesda---------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High.
Hu---------- Huntington	B	Occasional	Brief-----	Dec-May	4.0-6.0	Apparent	Dec-Apr	>60	---	Low------	Moderate.
LaC, LaD---------- Latham	D	None--------	---	---	1.5-3.0	Perched	Jan-Apr	20-40	Soft	High-----	High.
LDF:											
Latham-----------	D	None--------	---	---	1.5-3.0	Perched	Jan-Apr	20-40	Soft	High-----	High.
DeKalb-----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High.
LlC---------- Lily	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
LSD:											
Lily	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High.
Steinsburg	C	None	---	---	>6.0	---	---	24-40	Soft	Low	High.
Mo Morehead	C	Rare	---	---	0.5-1.5	Apparent	Dec-Apr	>60	---	Moderate	High.
Ne Newark	C	Occasional	Brief	Jan-Apr	0.5-1.5	Apparent	Dec-May	>60	---	High	Low.
Pd: Pits. Dumps.											
Pg Pope	B	Frequent	Very brief to brief.	Nov-Apr	>6.0	---	---	>60	---	Low	High.
RSF:											
Rigley	B	None	---	---	>6.0	---	---	>60	---	Low	High.
Shelocta	B	None	---	---	>6.0	---	---	>48	Hard	Low	High.
Rock outcrop.											
ShB, ShC, ShD Shelocta	B	None	---	---	>6.0	---	---	>48	Hard	Low	High.
SLE, SLF:											
Shelocta	B	None	---	---	>6.0	---	---	>48	Hard	Low	High.
Latham	D	None	---	---	1.5-3.0	Perched	Jan-Apr	20-40	Soft	High	High.
SSF:											
Steinsburg	C	None	---	---	>6.0	---	---	24-40	Soft	Low	High.
Shelocta	B	None	---	---	>6.0	---	---	>48	Hard	Low	High.
Rock outcrop.											
St Stendal	C	Frequent	Very brief	Jan-May	1.0-2.0	Apparent	Jan-Apr	>60	---	High	High.
Sv Stokly	B	Frequent	Very brief	Dec-May	0.5-1.0	Apparent	Dec-May	>60	---	Moderate	High.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
WnB, WnC, WnD----- Wernock	B	None--------	---	---	>6.0	---	---	30-40	Soft	Moderate	High.
WtA, WtB, WtC----- Whitley	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High.

TABLE 17.--PHYSICAL ANALYSES OF SELECTED SOILS

[A dash indicates material was not detected. An asterisk indicates the determination was not made. The Cr horizon was not sampled in these soils]

Soil name, report number, horizon, and depth in inches	Size class and particle diameter (mm)											Coarse fragments		
	Total			Sand										
	Sand (2-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.1)	Coarse (1-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)	Sand coarser than very fine (2-0.1)	Very fine sand plus silt (0.1-0.002)	Textural class 1/	>2 mm	2-19 mm	19-76 mm
	Pct <2 mm											Pct	Pct	Pct
Bethesda channery silt loam 2/: (78-KY-121-8)														
Ap - - - - - - 0-12	25.2	51.8	23.0	3.9	2.9	2.3	7.8	8.3	16.9	60.1	cnsil	34.9	24.4	10.5
C1 - - - - - - 12-36	44.0	40.3	15.7	4.5	6.5	7.8	17.6	7.6	36.4	47.9	l	2.2	2.2	---
C2 - - - - - - 36-58	42.0	40.0	18.0	3.2	4.6	7.4	18.8	8.0	34.0	48.0	l	8.9	1.8	7.1
C3 - - - - - - 58-72	41.7	38.2	20.1	2.9	4.9	7.5	17.2	9.2	32.5	47.4	l	4.0	4.0	---
Fairpoint gravelly silt loam 2/: (78-KY-121-10)														
Ap - - - - - - 0-12	27.8	58.1	14.1	2.9	3.2	2.6	10.2	8.9	18.9	67.0	grsil	47.2	27.7	19.5
C1 - - - - - - 12-32	41.1	46.5	12.4	3.0	3.7	5.2	19.8	9.4	31.7	55.8	vgrl	46.6	22.0	24.6
C2 - - - - - - 32-60	28.4	57.4	14.2	4.2	3.5	2.4	8.9	9.4	19.0	66.8	vgrsil	50.9	28.6	22.3
Latham silt loam 2/: (78-KY-121-2)														
A1 - - - - - - 0-1	18.1	60.7	21.2	1.9	1.7	1.1	4.2	9.2	8.9	69.9	sil	3.4	3.4	*
B1 - - - - - - 1-6	15.0	51.3	33.7	2.3	1.7	0.7	3.2	7.1	7.9	58.4	sicl	0.9	0.9	*
B21t - - - - - 6-13	11.2	41.4	47.4	3.4	2.6	1.0	2.2	2.0	9.2	43.4	sic	---	---	---
B22t - - - - - 13-20	7.9	40.3	51.8	2.4	2.0	0.6	1.4	1.5	6.4	41.8	sic	---	---	---
B3 - - - - - - 20-24	12.2	55.8	32.0	4.0	3.5	1.0	2.1	1.6	10.6	57.4	sicl	0.7	0.7	*
Morehead silt loam 2/ 3/: (78-KY-121-3)														
Ap - - - - - - 0-6	30.6	53.2	16.2	1.2	0.9	3.4	14.3	10.8	19.8	64.0	sil	---	---	---
B1 - - - - - - 6-12	32.3	51.5	16.2	1.0	1.1	3.3	14.4	12.5	19.8	64.0	sil	---	---	---
B21t - - - - - 12-19	30.9	52.3	16.8	1.3	1.0	3.1	13.9	11.6	19.3	63.9	sil	0.2	0.2	---
B22t - - - - - 19-34	28.8	51.4	19.8	1.2	1.2	3.1	12.7	10.6	18.2	62.0	sil	---	---	---
B22t - - - - - 34-49	28.1	50.9	21.0	1.3	1.5	3.2	12.2	9.9	18.2	60.8	sil	1.0	1.0	---
C - - - - - - 49-67	31.0	45.9	23.1	2.5	3.0	4.1	12.4	9.0	22.0	54.9	l	0.5	0.5	---

See footnotes at end of table.

TABLE 17.--PHYSICAL ANALYSES OF SELECTED SOILS--Continued

Soil name, report number, horizon, and depth in inches	Size class and particle diameter (mm)											Coarse fragments		
	Total			Sand					Sand coarser than very fine (2-0.1)	Very fine sand plus silt (0.1-0.002)	Textural class 1/			
	Sand (2-0.05)	Silt (0.05-0.002)	Clay (<0.002)	Very coarse (2.1)	Coarse (1-0.5)	Medium (0.5-0.25)	Fine (0.25-0.1)	Very fine (0.1-0.05)				>2 mm	2-19 mm	19-76 mm
	Pct <2 mm											Pct	Pct	Pct
Shelocta loam 4/: (78-KY-121-4)														
A1 - - - - - - 0-6	37.7	45.9	16.4	3.4	4.0	5.0	13.3	12.0	25.7	57.9	1	19.2	19.2	*
B1 - - - - - - 6-12	37.6	48.3	14.1	2.4	4.2	5.1	13.3	12.6	25.0	60.9	cnl	23.5	19.0	4.5
B21t - - - - - 12-22	41.1	46.0	12.9	4.5	5.3	5.2	13.4	12.7	28.4	58.7	cnl	33.3	26.8	6.5
B22t - - - - - 22-33	35.5	45.7	18.8	4.4	4.8	4.7	11.3	10.3	25.2	56.0	cnl	24.8	21.5	3.3
B23t - - - - - 33-44	31.0	46.1	22.9	2.9	4.2	4.4	10.5	9.0	22.0	55.1	1	15.0	14.4	0.6
C - - - - - - 44-72	36.3	48.4	15.3	4.3	4.4	4.7	11.8	11.1	25.2	59.5	cnl	42.5	35.6	6.9
Stendal silt loam 2/ 5/: (78KY-121-5)														
Ap - - - - - - 0-8	30.1	50.3	19.6	0.9	1.3	3.4	11.8	12.7	17.4	63.0	sil	0.8	0.8	*
C1 - - - - - - 8-16	25.0	54.4	20.6	0.1	0.6	2.9	10.5	10.9	14.1	65.3	sil	---	---	---
C2g - - - - - 16-27	27.0	47.4	25.6	0.1	0.9	3.8	10.5	11.7	15.3	59.1	1	---	---	---
C3g - - - - - 27-35	28.8	49.7	21.5	0.1	0.7	2.8	11.8	13.4	15.4	63.1	1	---	---	---
C4g - - - - - 35-48	25.2	50.8	24.0	0.1	0.5	2.0	9.2	13.4	11.8	64.2	sil	---	---	---
C5g - - - - - 48-60	18.9	51.7	29.4	0.5	2.8	2.1	5.7	7.8	11.1	59.5	sicl	---	---	---

1/ Coarse fragments larger than 3 inches were discarded from lab sample. Please refer to the description of the typifying pedon for the total volume of coarse fragments as well as the appropriate texture.

2/ Location of pedon sampled is the same as given for the typical pedon in "Soil Series and Their Morphology."

3/ The B22t horizon was divided for sampling purposes.

4/ Shelocta loam: 0.6 mile up John's Branch from Kentucky Highway 23, 3.5 miles northeast of Dewitt.

5/ The Cg2 and Cg3 horizons were estimated in the field to be silt loam. The loam texture is outside the range of the official series; however, the difference in the silt content for the horizons to be silt loam is within the range of error of laboratory determination.

TABLE 18.--CHEMICAL ANALYSES OF SELECTED SOILS

[The symbol < means less than]

Soil name, report number, horizon, and depth in inches	Reaction		Extractable cations					Cation exchange capacity		Extractable Acidity	Aluminum	Base saturation		Oganic matter	Calcium carbonate equivalent	Phosphorus
	H_2O (1:1)	KCl 1N (1:1)	Ca	Mg	K	Na	TEC	AA	SUM			AA	SUM			
	pH	pH	Milliequivalents per 100 grams of soil									Pct	Pct	Pct	Pct	Ppm
Bethesda channery silt loam 1/: (78-KY-12I-8)																
Ap - - - 0-12	5.7	4.5	2.4	4.4	0.2	0.4	7.4	8.1	9.7	2.3	0.2	91	76	1.86	0.15	3.0
C1 - - - 12-36	5.1	3.6	0.7	2.0	0.3	0.3	3.3	7.3	5.9	2.6	0.5	45	56	0.79	0.13	2.0
C2 - - - 36-58	4.6	3.5	0.5	1.8	0.3	0.4	3.0	6.1	4.8	1.8	0.5	49	62	0.40	0.15	1.0
C3 - - - 58-72	5.0	3.6	0.6	1.5	0.3	0.3	2.7	6.9	7.2	4.5	0.8	39	38	2.40	0.31	1.0
Fairpoint gravelly silt loam 1/: (78-KY-12I-10)																
Ap - - - 0-12	6.8	5.7	1.6	1.8	0.1	0.1	3.6	7.4	6.8	3.2	0.1	49	53	1.36	0.11	7.0
C1 - - - 12-32	5.9	4.7	2.3	2.1	0.1	0.1	4.6	6.6	6.9	2.3	<0.1	70	67	0.39	0.09	6.0
C2 - - - 32-60	6.7	5.4	1.1	3.6	0.1	0.3	5.1	7.2	5.7	0.6	0.1	71	90	0.96	0.12	5.0
Latham silt loam 1/: (78-KY-121-2)																
A1 - - - 0-1	4.7	3.6	2.3	0.7	0.4	0.5	3.9	11.5	20.5	16.6	0.9	34	19	8.22	0.38	16.0
B1 - - - 1-6	4.4	3.5	0.2	0.2	0.2	0.5	1.1	9.8	12.3	11.2	1.4	11	9	1.63	0.27	<1.0
B21t - - 6-13	4.1	3.5	0.1	0.5	0.2	0.3	1.1	12.9	13.9	12.8	2.4	9	8	0.96	0.24	0.5
B22t - - 13-20	4.6	3.5	0.1	0.8	0.2	0.3	1.4	13.1	12.7	11.3	1.5	11	11	0.58	0.18	<0.5
B3 - - - 20-24	4.8	3.6	0.1	0.8	0.2	0.2	1.3	11.0	12.5	11.2	0.3	12	10	0.41	0.12	<0.5
Morehead silt loam 1/ 2/: (78-KY-I21-3)																
Ap - - - 0-6	5.7	4.5	3.5	0.6	0.1	0.4	4.6	6.4	10.0	5.4	<0.1	72	46	2.55	0.10	1.5
B1 - - - 6-12	5.8	4.3	2.5	0.3	0.1	0.4	3.3	4.6	5.3	2.0	0.1	72	63	0.58	0.20	<0.5
B21t - - 12-19	4.7	3.7	1.1	0.6	0.1	0.1	1.8	4.7	7.2	5.4	0.2	38	25	0.35	0.20	<0.5
B22t - - 19-34	5.2	3.7	1.0	0.8	0.1	0.1	2.0	5.3	6.4	4.4	0.1	38	31	0.30	<0.10	<0.5
B22t - - 34-49	5.2	3.7	0.8	0.7	0.1	0.1	1.7	5.7	6.8	5.1	<0.1	30	25	0.29	0.10	<0.5
C - - - 49-67	5.0	3.8	1.0	1.7	0.1	0.1	2.9	6.9	9.4	6.5	0.1	42	31	0.37	0.10	<0.5

See footnotes at end of table.

TABLE 18.--CHEMICAL ANALYSES OF SELECTED SOILS--Continued

Soil name, report number, horizon, and depth in inches	Reaction		Extractable cations					Cation exchange capacity		Extractable Acidity	Aluminum	Base saturation		Oganic matter	Calcium carbonate equivalent	Phosphorus
	H_2O (1:1)	KCl 1N (1:1)	Ca	Mg	K	Na	TEC	AA	SUM			AA	SUM			
	pH	pH	Milliequivalents per 100 grams of soil									Pct	Pct	Pct	Pct	Ppm
Shelocta loam 3/: (78-KY-121-4)																
A1 - - - 0-6	4.7	3.7	0.1	0.1	0.2	<0.1	0.3	8.9	10.7	10.4	0.2	4	3	2.97	0.14	6.0
B1 - - - 6-12	4.6	3.6	0.1	0.1	0.1	<0.1	0.3	4.7	4.4	4.1	0.2	6	7	0.79	0.10	1.5
B21t - - 12-22	4.6	3.5	0.3	0.2	0.1	0.1	0.6	4.1	3.9	3.3	0.1	15	16	0.51	0.09	1.5
B22t - - 22-33	4.9	3.5	0.5	0.4	0.1	0.1	1.1	5.7	5.3	4.2	0.1	20	21	0.30	0.10	0.5
B23t - - 33-44	4.8	3.4	0.3	0.5	0.1	0.1	1.1	7.1	18.6	17.5	0.2	15	6	0.30	0.07	1.0
C - - - 44-72	5.1	3.5	0.1	0.7	0.1	0.1	0.9	6.0	20.2	19.3	0.2	15	5	0.11	<0.05	0.5
Stendal silt loam 1/: (78-KY-121-5)																
Ap - - - 0-8	5.7	4.6	3.5	1.0	0.2	0.4	5.1	6.6	11.2	6.1	0.1	77	45	2.41	0.18	7.0
C1 - - - 8-16	5.3	4.0	2.0	0.8	0.1	0.4	3.3	6.2	8.5	5.2	0.2	53	39	1.28	0.11	2.5
C2g - - 16-27	5.4	4.1	2.6	1.7	0.1	0.4	4.8	8.5	12.4	7.6	0.2	57	39	1.39	0.13	2.0
C3g - - 27-35	5.5	4.1	2.6	1.8	0.2	0.4	5.0	7.2	8.5	3.5	0.2	69	59	1.23	0.13	4.0
C4g - - 35-48	5.6	4.2	2.3	1.8	0.1	0.3	4.5	7.7	10.9	6.4	0.1	60	41	0.89	0.25	2.5
C5g - - 48-60	5.4	4.0	2.5	2.5	0.2	0.3	5.5	8.8	14.9	9.4	0.2	63	37	0.88	0.13	2.5

1/ Location of pedon sampled is the same as given for the typical pedon in "Soil Series and Their Morphology."
2/ The B22t horizon was divided for sampling purposes.
3/ Shelocta loam: 0.6 mile up John's Branch from Kentucky Highway 223, 3.5 miles northeast of Dewitt.

TABLE 19.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon and depth in inches	Classification		Grain-size distribution											Liquid limit	Plasticity index	Moisture density		Specific gravity
			Percentage passing sieve--							Percentage smaller than--						Max-dry density	Optimum moisture	
	AASHTO	Unified	3 inch	2 inch	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm					
														Pct		Lb/ft^3	Pct	
Bethesda channery silt loam 1/: (78-KY-121-8)																		
C1 - - - - - 12-36	A-4	SC-SM	100	99	94	87	80	70	63	42	36	20	12	27	7	113	14	2.73
C2 - - - - - 36-58	A-4	SC-SM	100	90	85	79	76	70	65	47	37	22	13	28	7	112	15	2.74
C3 - - - - - 58-72	A-4	SC-SM	100	96	93	90	86	77	71	48	39	25	14	29	7	109	16	2.78
Fairpoint gravelly silt loam 1/: (78-KY-121-10)																		
C2 - - - - - 32-60	A-4	GC-GM	100	99	87	77	68	56	52	45	32	14	10	31	8	115	13	2.78
Latham silt loam 1/: (78-KY-121-2)																		
B22t - - - - - 13-20	A-7-5	MH	100	100	100	100	100	100	100	96	86	64	43	68	32	95	26	2.74
Morehead silt loam 1/: (78-KY-121-3)																		
B22t - - - - - 19-49	A-4	CL	100	100	100	100	100	100	96	77	58	32	20	33	10	107	18	2.71
C - - - - - - 49-67	A-6	CL	100	100	100	100	100	100	93	69	48	33	20	36	12	107	18	2.73
Shelocta loam 2/: (78-KY-121-4)																		
B22t&B23t - 22-44	A-4	CL	100	100	100	100	100	100	87	66	47	32	17	28	8	115	14	2.71
C - - - - - - 44-72	A-4	SC-SM	100	99	93	87	82	76	67	48	34	18	9	27	7	114	13	2.70
Stendal silt loam 1/: (78-KY-121-5)																		
C2 - - - - - 16-22	A-4	ML	100	100	100	100	100	100	98	74	52	32	17	37	10	101	20	2.68
C5 - - - - - 48-60	A-6	ML	100	100	100	100	100	100	98	85	59	32	20	38	11	101	20	2.71

1/ Location of pedon sampled is the same as given for the typical pedon in "Soil Series and Their Morphology."
2/ Shelocta loam: 0.6 mile up John's Branch from Kentucky Highway 223, 3.5 miles northeast of Dewitt.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Allegheny	Fine-loamy, mixed, mesic Typic Hapludults
Bethesda	Loamy-skeletal, mixed, acid, mesic Typic Udorthents
Bledsoe	Fine, mixed, mesic Typic Hapludalfs
Bonnie	Fine-silty, mixed, acid, mesic Typic Fluvaquents
Clarkrange	Fine-silty, siliceous, mesic Typic Fragiudults
Cotaco	Fine-loamy, mixed, mesic Aquic Hapludults
Cuba	Fine-silty, mixed, mesic Fluventic Dystrochrepts
DeKalb	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Fairpoint	Loamy-skeletal, mixed, nonacid, mesic Typic Udorthents
Huntington	Fine-silty, mixed, mesic Fluventic Hapludolls
Latham	Clayey, mixed, mesic Aquic Hapludults
Lily	Fine-loamy, siliceous, mesic Typic Hapludults
*Morehead	Fine-silty, mixed, mesic Aquic Hapludults
Newark	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Rigley	Coarse-loamy, mixed, mesic Typic Hapludults
*Shelocta	Fine-loamy, mixed, mesic Typic Hapludults
Steinsburg	Coarse-loamy, mixed, mesic Typic Dystrochrepts
Stendal	Fine-silty, mixed, acid, mesic Aeric Fluvaquents
Stokly	Coarse-loamy, mixed, acid, mesic Aeric Fluvaquents
Wernock	Fine-silty, mixed, mesic Typic Hapludults
Whitley	Fine-silty, mixed, mesic Typic Hapludults

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

☆U. S. GOVERNMENT PRINTING OFFICE : 1988 O - 493-547 : QL 3

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.